

A02 = Special features/
test specifications

B01 = 2

Letters/	1	SIS																	
A	**XXX	XX*XX	XXXXX	XX															
B	*XXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
C	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
D	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
E	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX	XXXXX
F																			
G																			
H																			
I																			
J																			
K																			
L																			
M																			
N																			XX*

12345 67890 12345 67890 12345 678

1 2

1 = Tools and devices
2 = Complete instructions, divided into test steps (no references)

- a. Read from left to right.
- b. Title of micropicture (appears on each coordinate).

E16	Product/component/test step	
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Coordinate

- ### c. Limits of section

			
Beginning	Mid-section	End	One-page section

A01	—	=> <=
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Repair instructions for in-line pumps of series PE..ZW(M)..S 1 and S 1000 without governor, LDA (manifold-pressure compensator) and timing device. Please refer to the respective repair instructions for information on how to repair the various governors.

Projection of camshaft, top edge of measuring tool to
pump housing
Set value: $90 \pm 0,2$

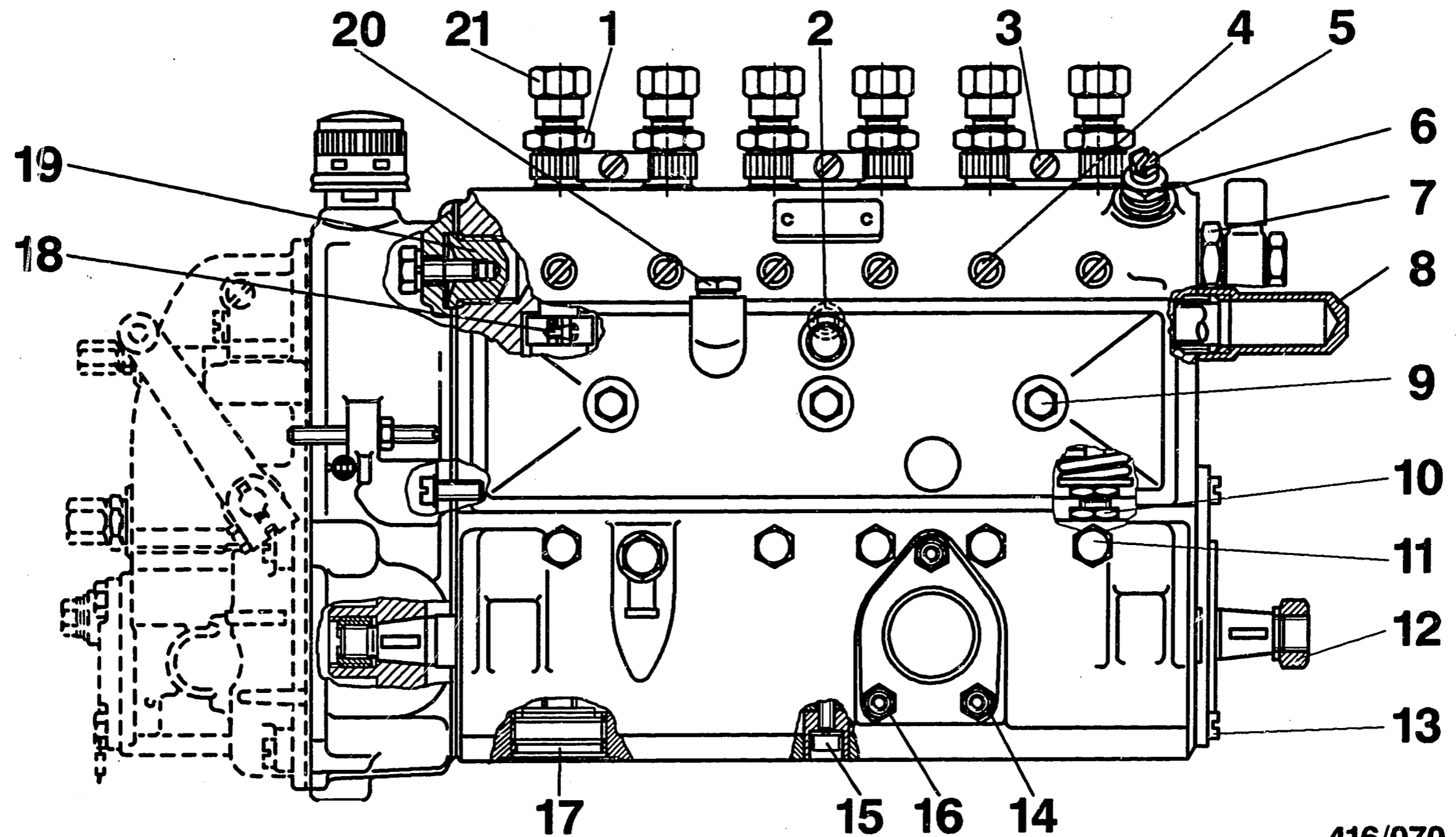
Tapered-roller bearing Set value: 0,02...0,06

Test duration and test pressure:
min. 1 minute at 5 bar

Test duration and test pressure:
30 min. at 5 bar, then
30 min. at 0.5 bar

Bolts, nuts etc. are indicated on the drawing as of Coordinate A03.
These items are repeated after every drawing and the tightening torque is given.

A02	—	=> <=
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416/070

TIGHTENING TORQUES

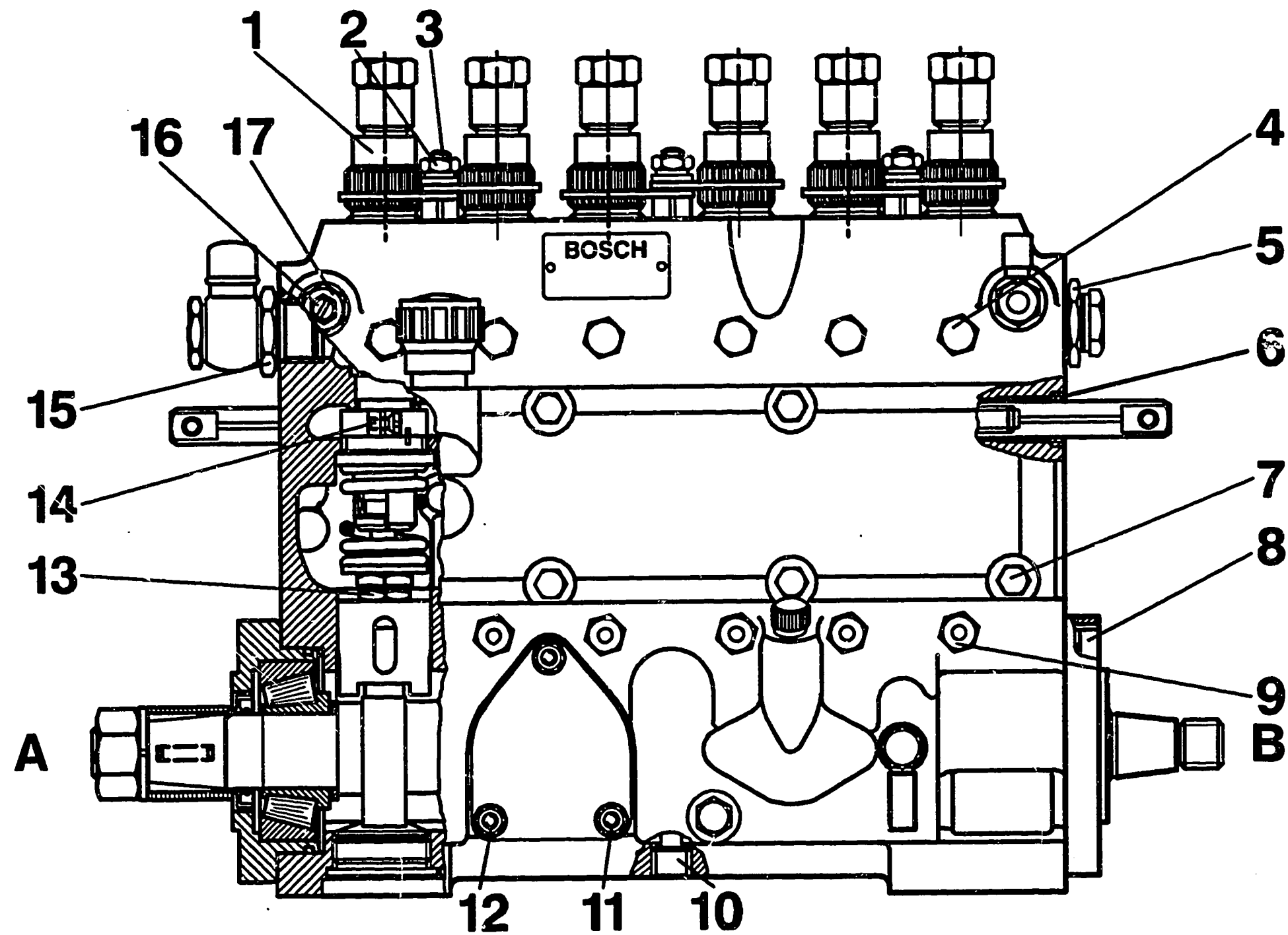
Refer to following Coordinates for values.

TIGHTENING TORQUES

Item no.	Designation	Torque (Nm)
1	Delivery-valve holder Polyamide seal ring up to code no. 2999	90-0-90...95 100-0-90...95
2	Control-rod positioning screw	10...14
3	Fillister-head screw	5...6.5
4	Baffle screw	40...50
5	Bleeder screw	4... 5
6	Threaded bushing	20...30
7	Threaded bushing	80...100
8	Control-rod closure cap	10
9	Cover screw plug	4... 6
10	Roller-tappet hexagon nut	60...70
11	Hexagon bolt	17...20
12	Hexagon nut Taper diameter 25 mm Taper diameter 30 mm	130...150 150...170
13	Cover fastening screw	20...24
14	Stay bolt	3... 4
15	Hexagon-socket- head cap screw, intermediate bearing	20...24

TIGHTENING TORQUES (continued)

Item No.	Designation	Torque (Nm)
16	Hexagon nut	3...4
17	Bottom screw plug	110...120
18	Clamping screw	5...6
19	Drain plug	80...100
20	Screw plug	25...42
21	Union nut	50...60



416/071

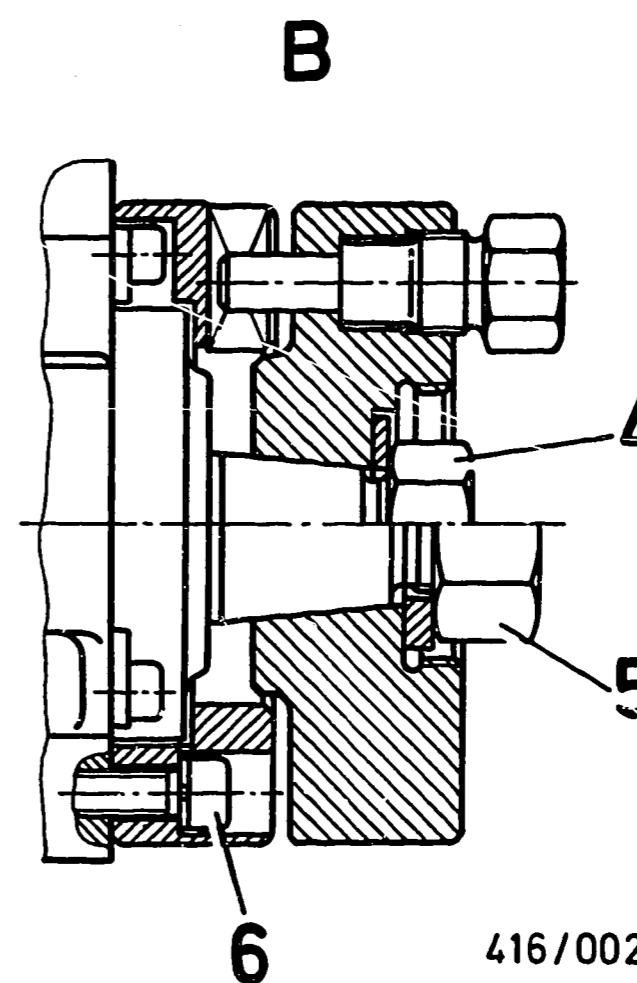
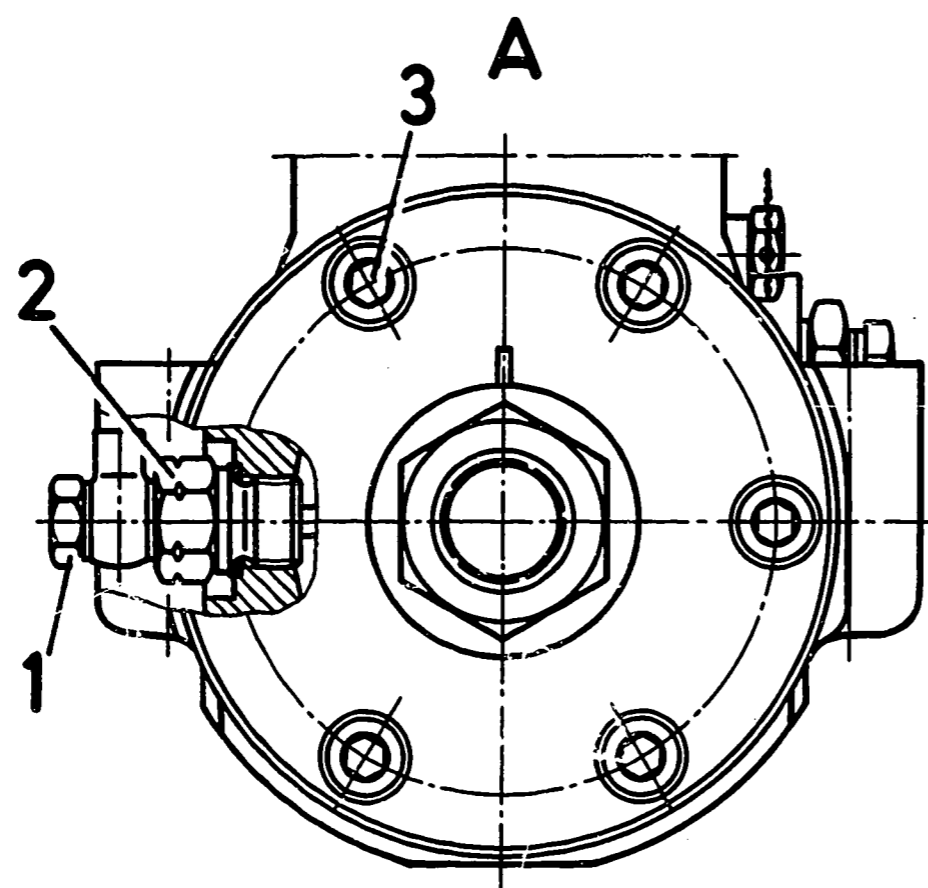
TIGHTENING TORQUES (continued)

Refer to following coordinates for values.

TIGHTENING TORQUES (continued)

Item no.	Designation	Torque (Nm)
1	Delivery-valve holder	
	Polyamide seal ring	90-0-90...95
	up to code no. 2999	100-0-90...95
2	Hexagon nut	11...15
3	Stay bolt	3...4
4	Baffle screw	
	M 10	25...30
	M 14	40...45
5	Threaded bushing	80...100
6	Control-rod guide bushing	4...6
7	Hexagon bolt	4...6
8	Bearing-end-plate fastening screw	6...8
9	Guide screw	17...20
10	Hexagon-socket-head cap screw	20...24
11	Stay bolt	3...4
12	Hexagon bolt	5...7
13	Roller-tappet hexagon nut	60...70
14	Clamping screw	5...6
15	Threaded bushing	80...100
16	Bleeder screw	5...6
17	Threaded bushing	20...30

For production reasons:
continued on the following
coordinate.



416/002

TIGHTENING TORQUES (continued)

Item no.	Designation	Torque (Nm)
1	Reducer bushing	18...12
2	Oil-supply valve	
	M 15x1.5	40...50
	M 18x1.5	45...55
3	Bearing-end-plate fastening screw	
	M 6	15...18
	M 8	20...24

Item no.	Designation	Torque (Nm)
4	Fastening nut Taper diameter 25 mm	200...225
5	Fastening nut Taper diameter 35 mm	200...225
6	Hexagon-socket-head cap screw	20... 24

GENERAL

- * Worn or damaged components and sealing elements are always to be renewed.
- * If fuel-injection-pump components are to be stored for a lengthy period, then they should be covered and protected against rust.
- * Leak test on governor chamber:
In order to avoid possible skin irritation when immersing hands in test bath, apply handcream beforehand and wash hands with soap and water following completion of test.
- * Cleaning of parts:
Wash out parts in commercially available cleaning agent, e.g. chlorothene NU, which is not readily flammable.
Then blow out with compressed air.
- * Safety precautions to be observed when handling combustible liquids:

In West Germany: Order Governing Work Involving Combustible Liquids (Vbf) as issued by the Federal Labor Ministry (BmA).

Safety regulations when handling chlorinated hydrocarbons:

— for companies ZH 1/222

— for employees ZH 1/129

as published by the Hauptverband für

Gewerbliche Berufsgenossenschaften (Zentralverband für Unfallschutz und Arbeitsmedizin) Langwartweg 103 5300 Bonn 5, West Germany.

Outside West Germany the corresponding local regulations are to be observed.

TOOLS AND DEVICES

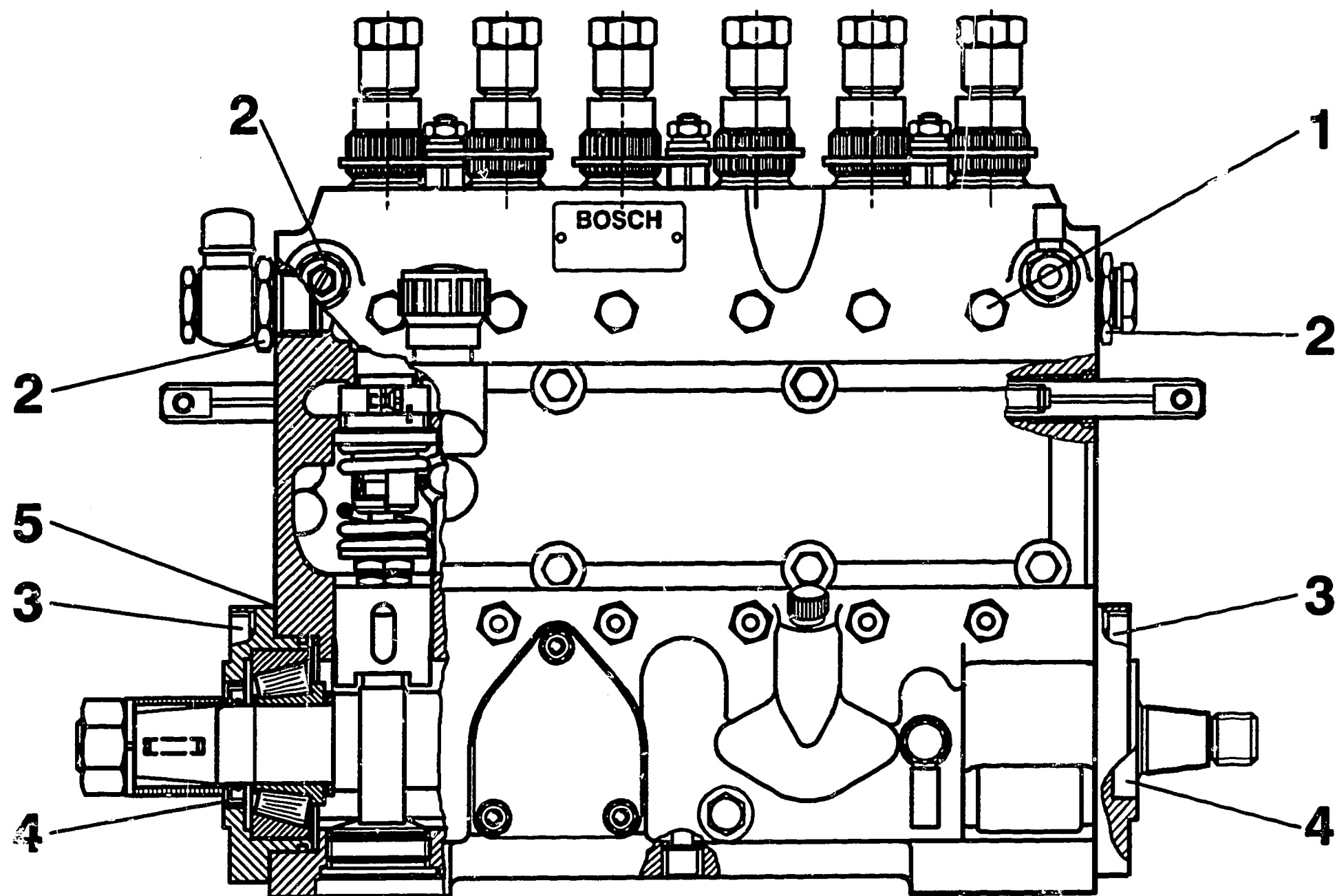
Designation	Part no.	Application
Clamping support	KDEP 2919	Clamping pump
Holding pieces	KDEP 2898	
Shaft for clamp- ing support	KDEP 2919/1/13	
Holding wrench	KDEP 1555	Holding camshaft at coupling half
Tappet holder	KDEP 2896	Locking tappet
Coupling half Taper		Turning through of camshaft
Diameter 30mm	1 686 430 034	
Screwing tool	KDEP 1072	Screwing in and unscrewing bottom screw plugs
Puller in conjunction with support bracket and threaded connector	KDAW 9990-3 KDEP 2883 KDEP 2883-2	Removing bearing end plate
Mounting sleeve Taper		Assembling radial-lip-type oil seals
Dia. 30 mm	KDEP 1502	
Taper		
Dia. 25 mm	KDEP 2925	
Tappet forceps	KDEP 2917	Assembling/disassembling roller tappet
Plunger pliers	KDEP 2942	Removing and installing pump plunger
Serrated wrench	KDEP 2920	Assembling/disassembling delivery-valve assemblies
Valve lifter	KDEP 2978	Removing delivery-valve assemblies

TOOLS AND DEVICES (continued)

Designation	Part no.	Application
Spring collet	KDAW 9995-22	Assembling bearing
Puller bell	KDAW 9995-40	outer rings
Hand cutter	KDEP 2958	Reworking plunger- and-barrel assembly seats
Extractor	KDEP 1056	Removing control- rod guide bushings
Sleeve	KDEP 1654	Guiding extractor (control-rod guide bushings)
Mandrel	KDEP 1655	Knocking in control- rod guide bushings
Pin-type socket wrench	KDEP 2873	Screwing in and unscrewing control- rod securing screws
Reamer	KDEP 2959	Smoothing control- rod guide bushings
Measuring sleeve Taper Dia. 30 mm	KDEP 1656	Checking installa- tion position of camshaft
Measuring tool Taper Dia. 30 mm	KDEP 2882	Checking axial clearance of camshaft
Clamping fixture	KDEP 1536	Pressing up roller tappet

TOOLS AND DEVICES (continued)

Designation	Part no.	Application
Plunger grippers	KDEP 2942	Installing and re- moving pump plunger
Release plate	KDEP 1580	Pressing off cam- shaft bearing
Pressing-on sleeve	KDEP 1583	Pressing on camshaft bearing
Pin-type socket wrench	KDEP 2970	Screwing in/unscrew- ing threaded bush- ing of control-rod guide bushing
Assembly tool	KDEP 1652	Assembling/dis- assembling control sleeve



416/072

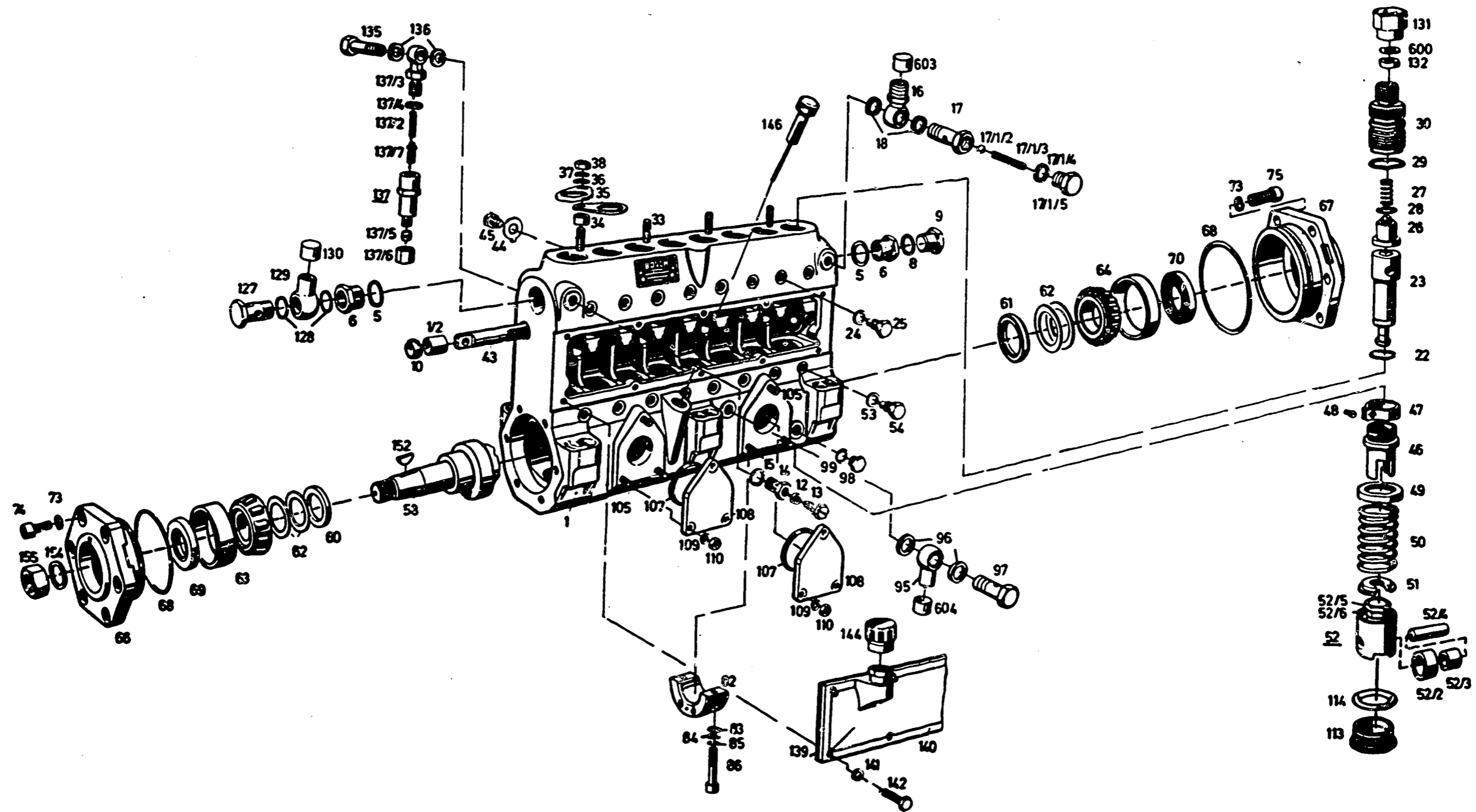
SEALING AND BONDING POINTS

Refer to following Coordinates for description.

SEALING AND BONDING POINTS, MATERIAL DESIGNATION
LUBRICANTS

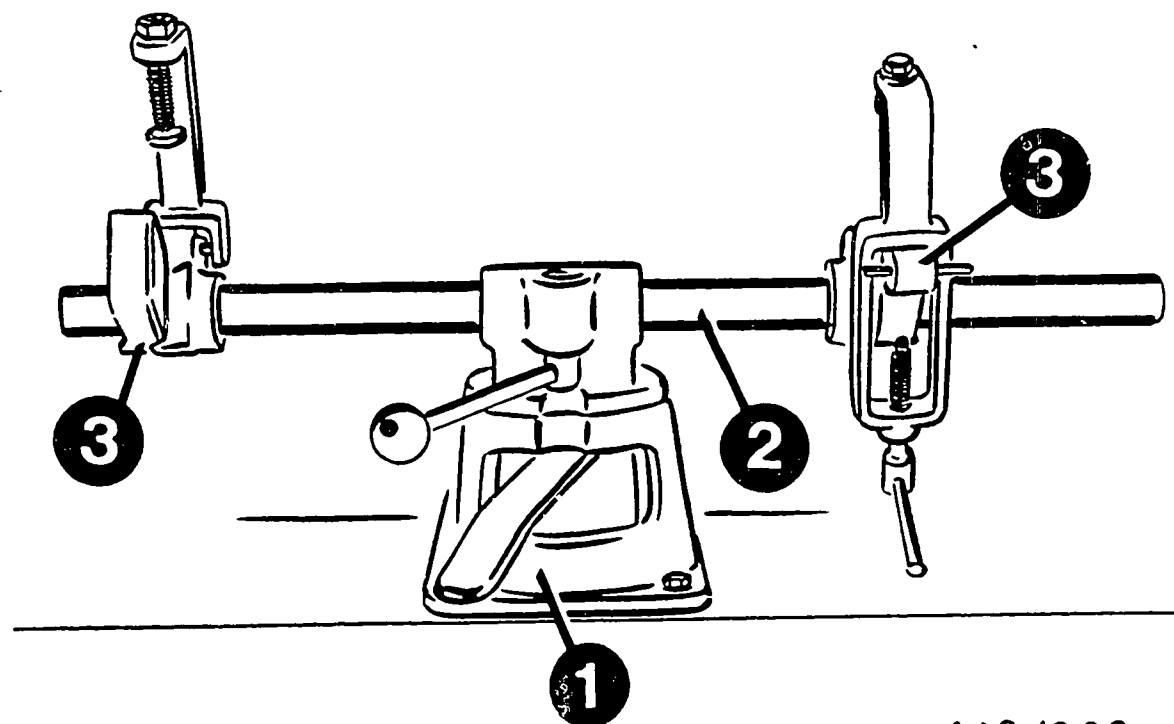
No.	Component design.	Name	Qty.	Part no.
1	Baffle screw	Surface sealing compound	Jar 50 g	5 970 100 512
2	Threaded bushing	Epoxy resin	50 ml	5 703 348 005
		Hardener	50 ml	5 707 567 005
3	Hexagon bolt	Epoxy resin	50 ml	5 703 348 005
	Hexagon-socket- head cap screw	Hardener	50 ml	5 707 567 005
4	Radial-lip- type oil seal	Talc		Comm. avail.
		Hot bearing grease	Tube 45 ml	5 700 002 005
			225 ml	5 700 002 025
6	Bearing end plate	Surface sealing compound	Jar 50 g	5 970 100 512

For production reasons:
continued on the following
coordinate.



416/073

EXPLODED VIEW

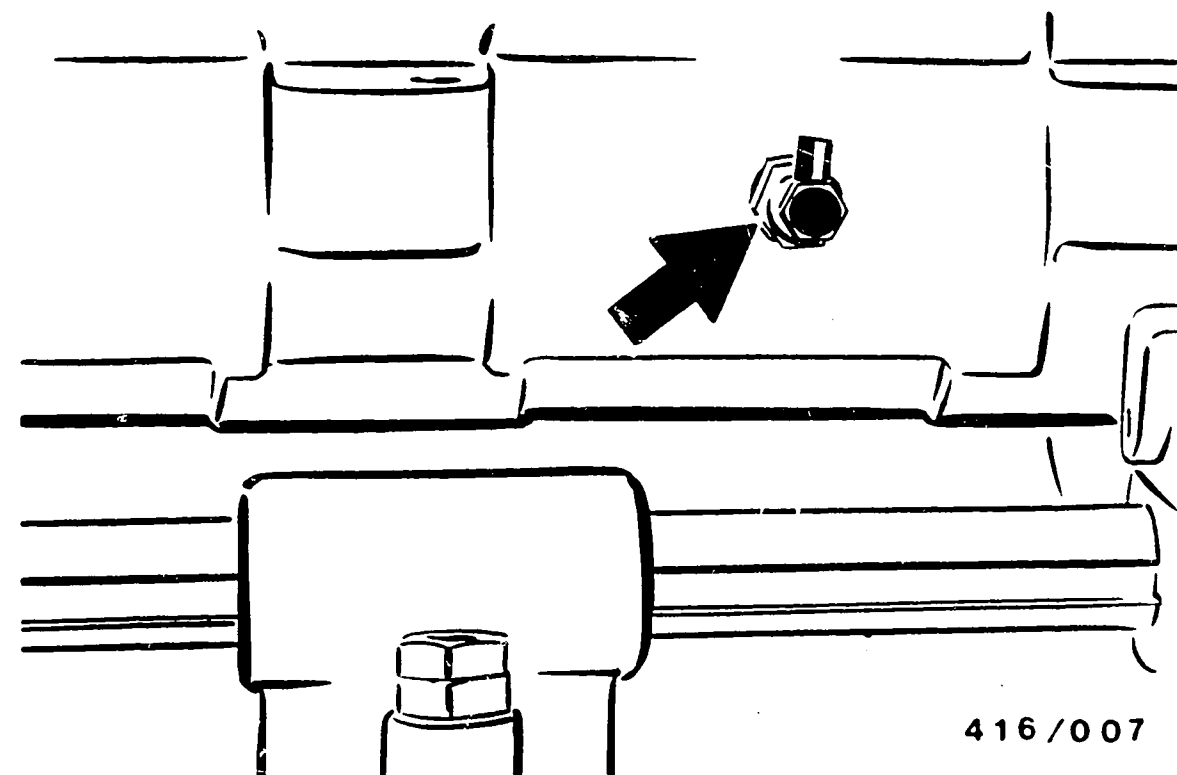


416/006

- 1 = Clamping support KDEP 2919
- 2 = Shaft for clamping support KDEP 2919/1/13
- 3 = Holding pieces KDEP 2898

CLAMPING FUEL-INJECTION PUMP

The clamping device shown in the picture is required for clamping the fuel-injection pump.



416/007

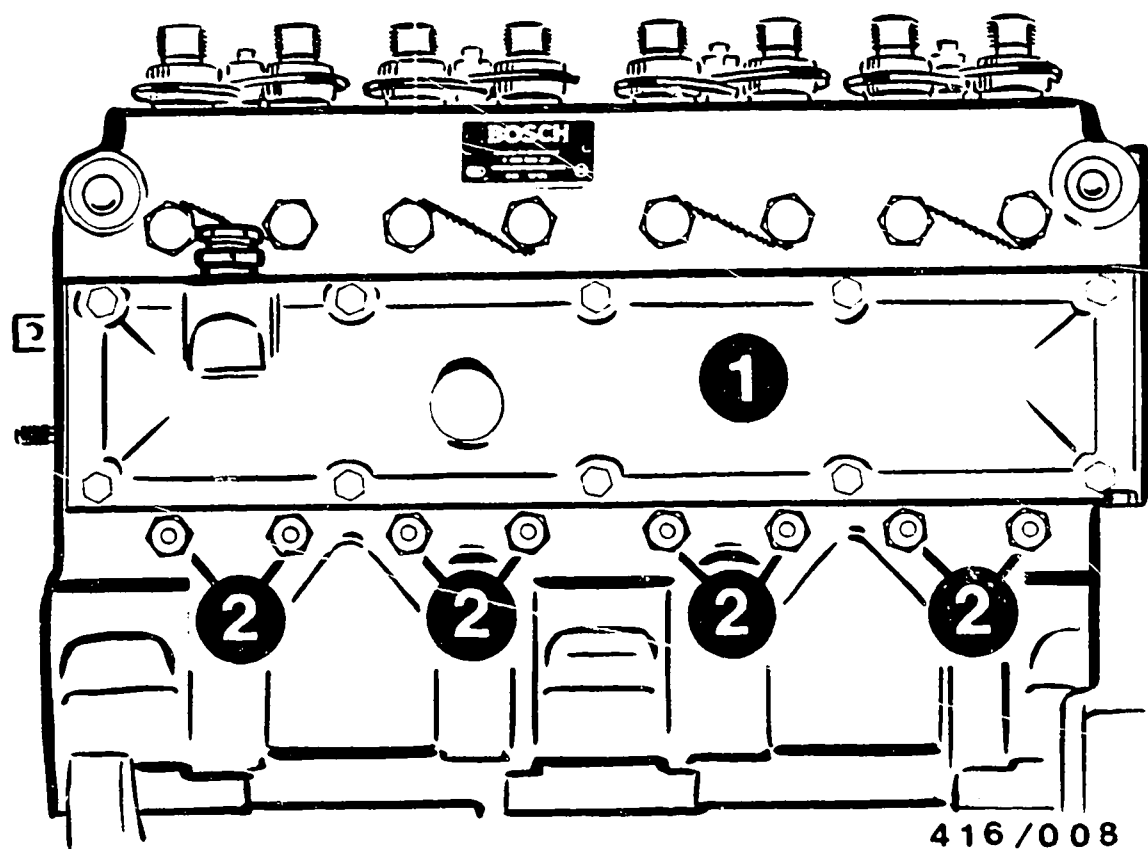
FUEL-INJECTION PUMP DISASSEMBLY

Remove fitted drive components (multi-plate clutch, toothed gear or timing device) using suitable tools.

Attach driving coupling in line with cone diameter of camshaft stub and secure it.

Disassemble governor in line with respective repair instructions.

Remove oil-supply valve (picture, arrow).

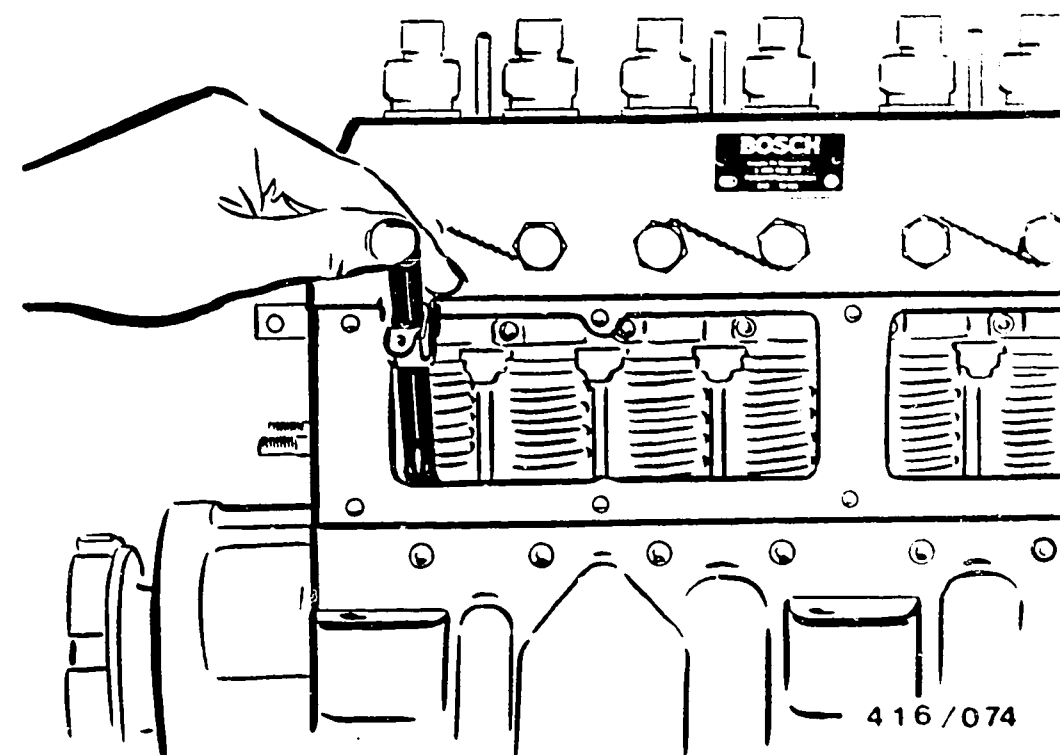


- 1 = Closing cover
2 = Roller-tappet guide screw

Remove closing cover and, if applicable, supply pump.

Unscrew roller-tappet guide screws. If applicable, remove mounting rail for plate washer.

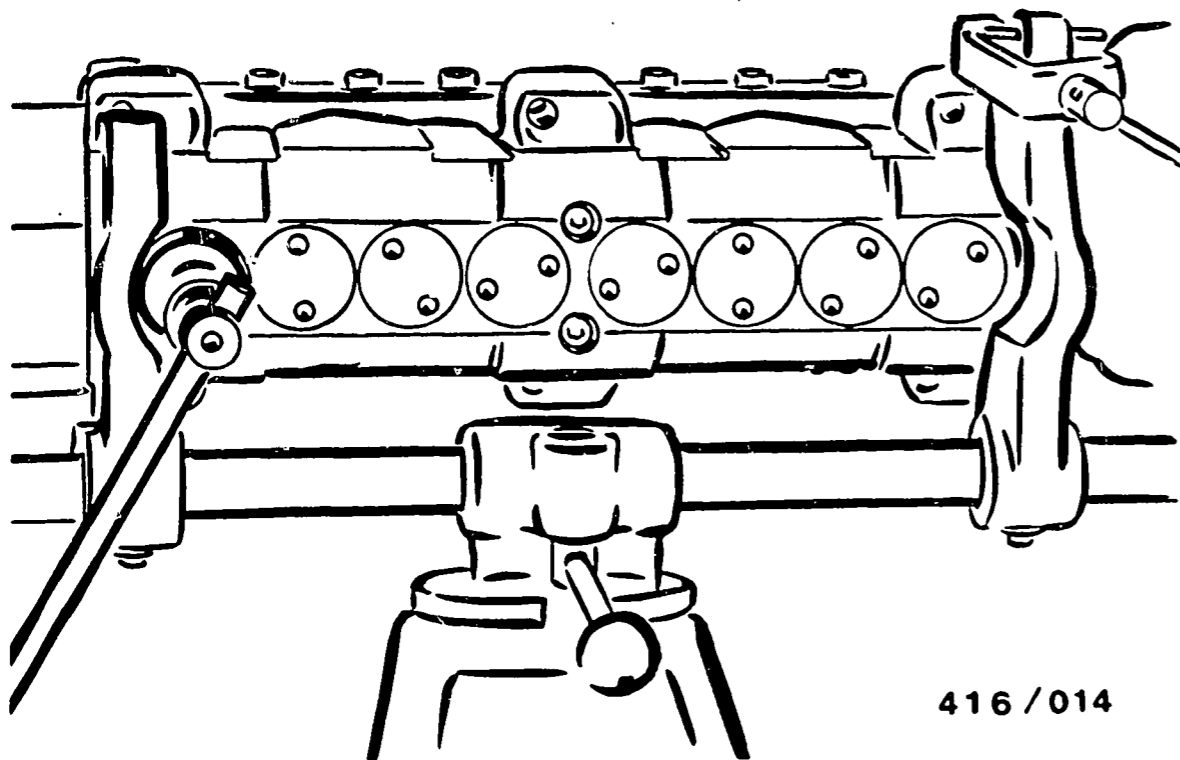
Note:
Depending on size of fuel-injection pump, have sufficient boxes available for accommodating components.



Turn camshaft with holding wrench and position roller tappet with tappet holder KDEP 2896 in TDC position of respective cam.

Press lever down. Support safety catch at upper closing-cover pilot. Camshaft must turn without making contact with roller tappet.

Note:
Do not lift roller tappet with tappet holder (without aid of cam); lug of tappet holder may break off.

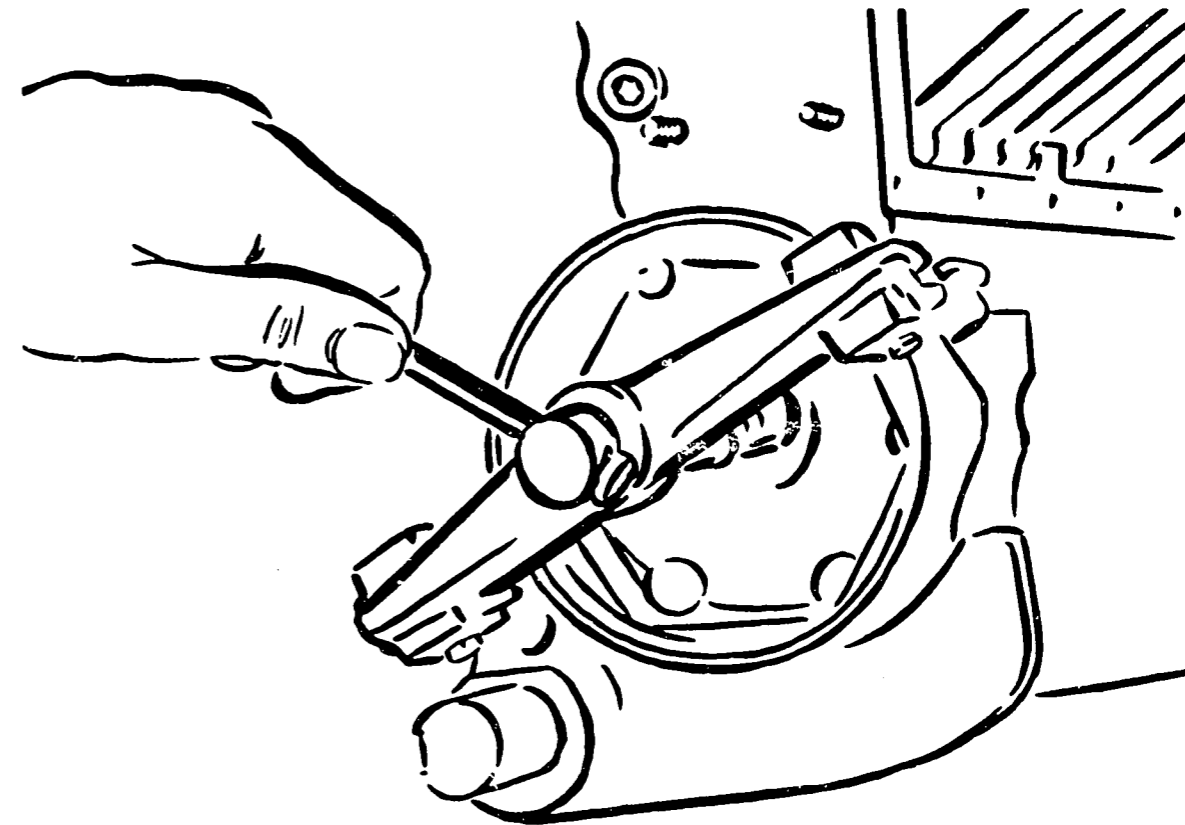


416 / 014

Remove driving coupling and Woodruff key.

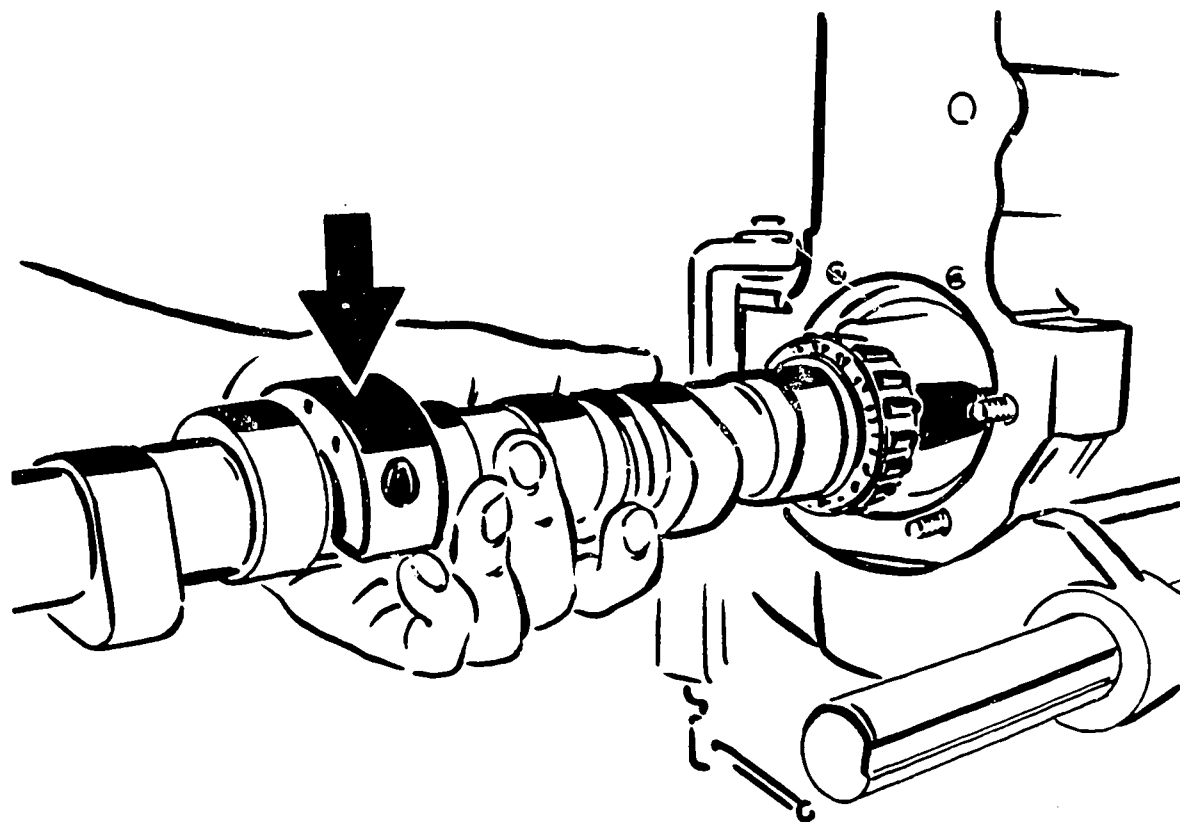
Tilt fuel-injection pump.

Remove base-cover screws using screwing tool KDEP 1072.



416 / 017

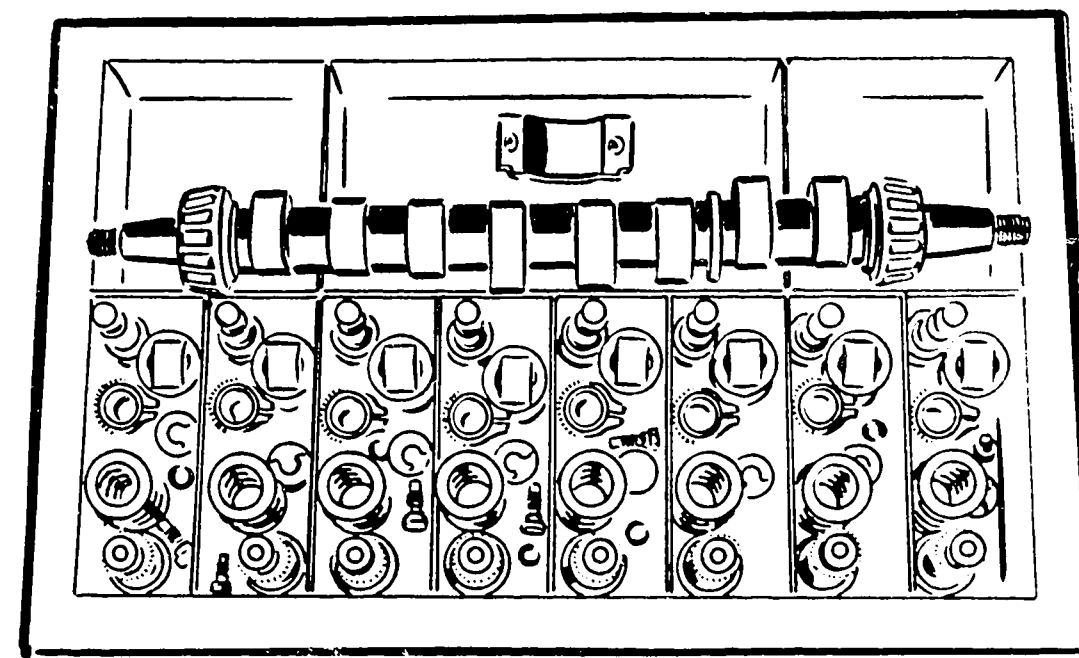
Loosen and detach bearing end plate on both sides of pump. To do so, use commercially available puller or KDAW 9990-3 in conjunction with support bracket KDEP 2883 and threaded connection KDEP 2883-2. Always make use of support bracket as otherwise camshaft would damage bearing.



416/018

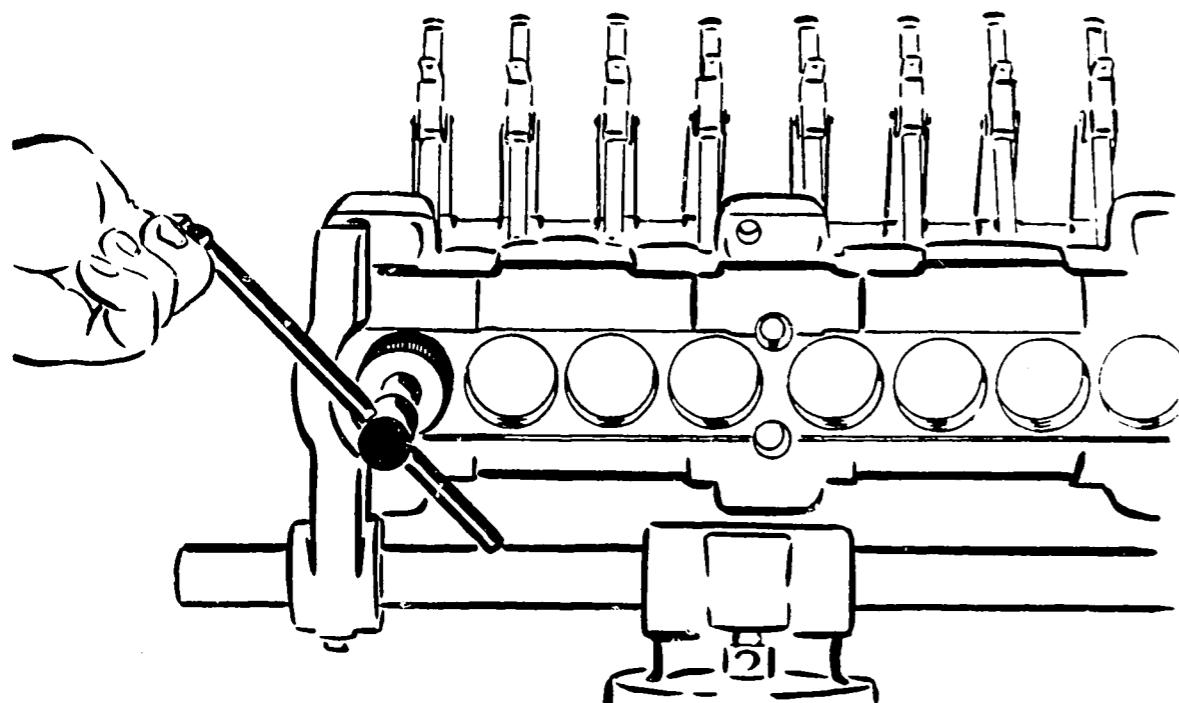
Remove screws at intermediate bearing
(screws are provided with O-rings).

Pull camshaft with intermediate bearing
(picture, arrow) out of camshaft chamber.



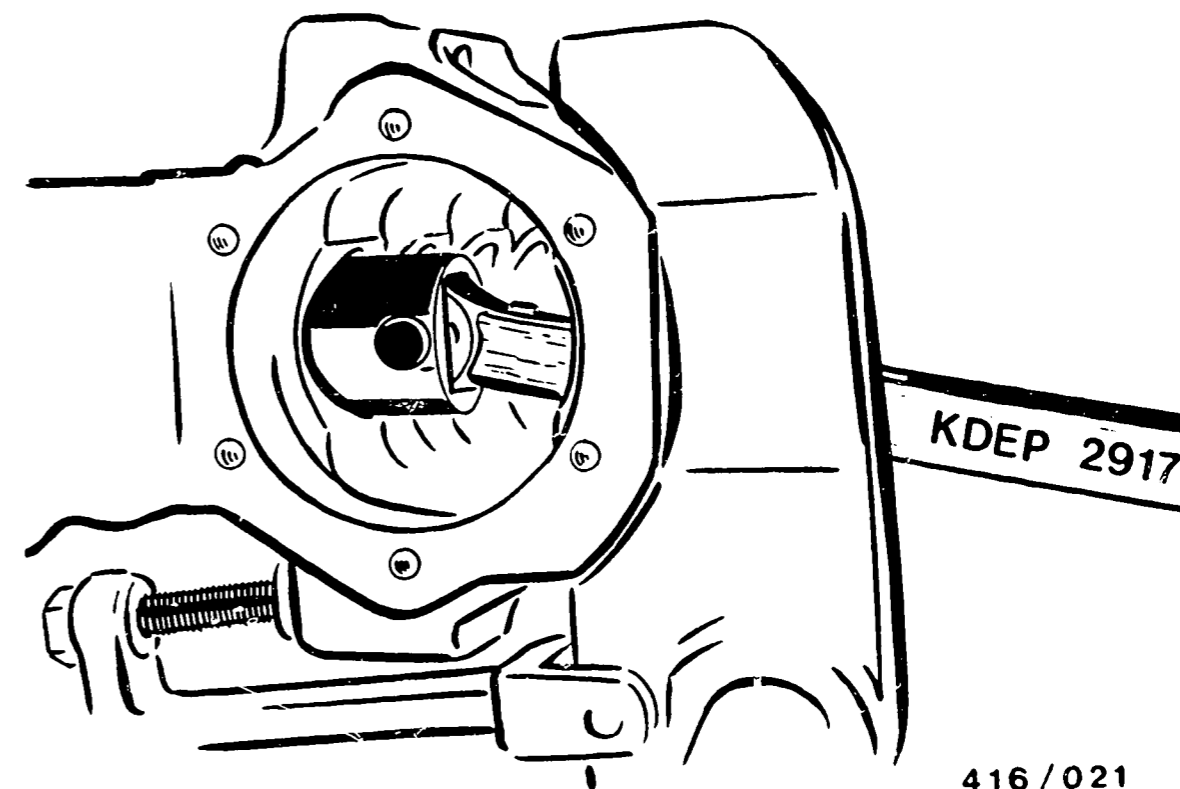
416/019

When performing subsequent work, all components
of one barrel assembly are to be deposited in
a clean, sub-divided box (e.g. picture).



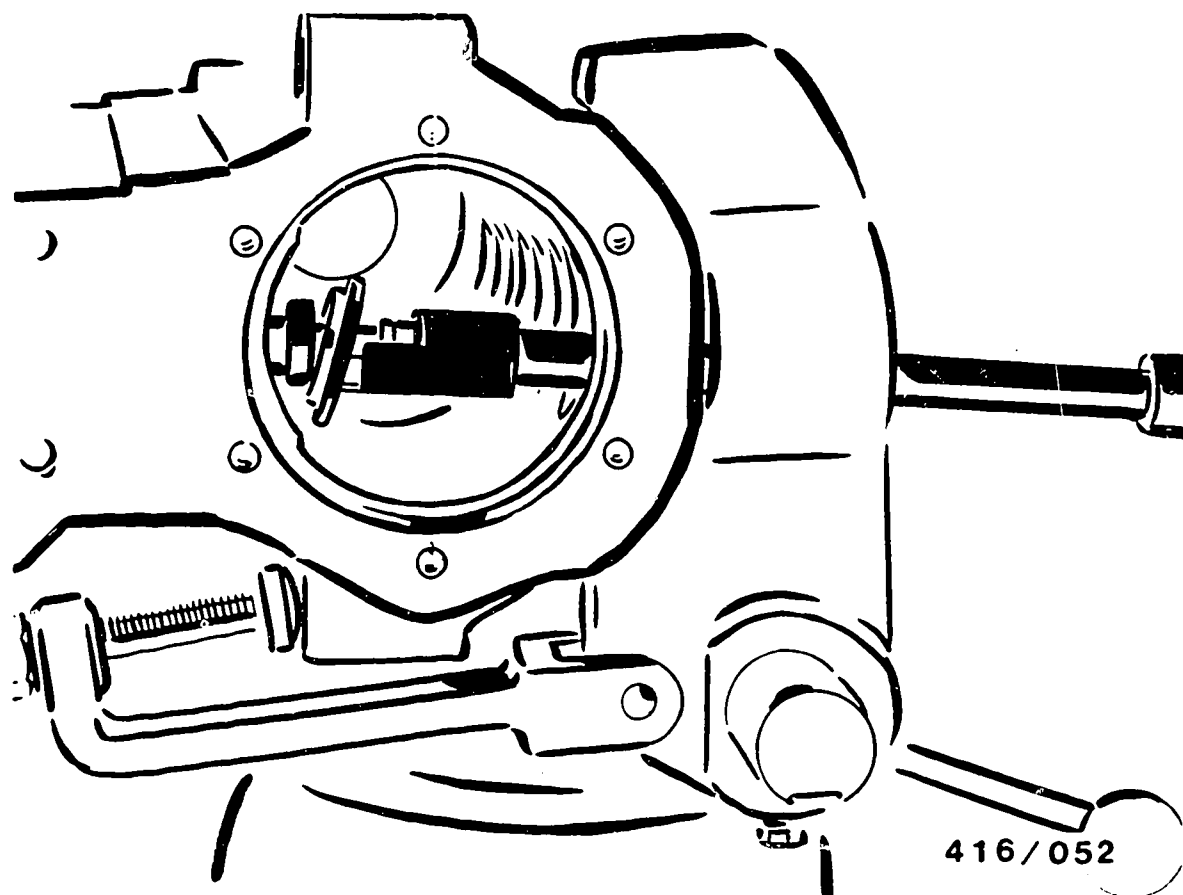
416 / 020

Press up roller tappet with clamping fixture KDEP 1536 and remove tappet holder.



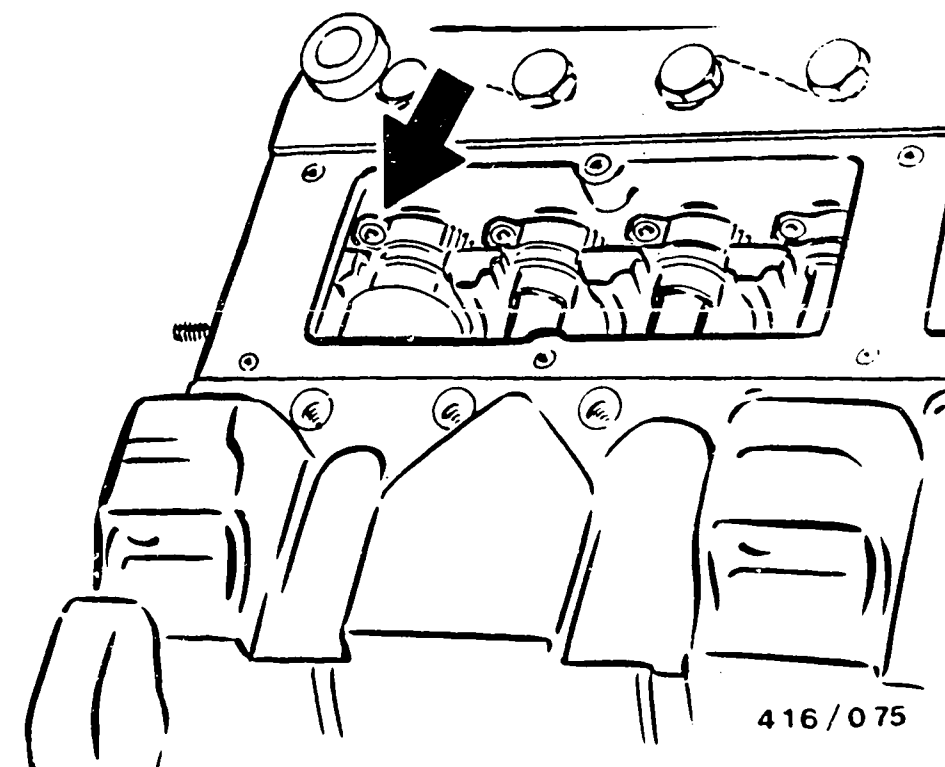
416 / 021

Release clamping fixture and remove roller tappet through hole in base with KDEP 2917.



Using plunger grippers KDEP 2942 carefully pull out pump plunger with lower spring seat through opening in base.

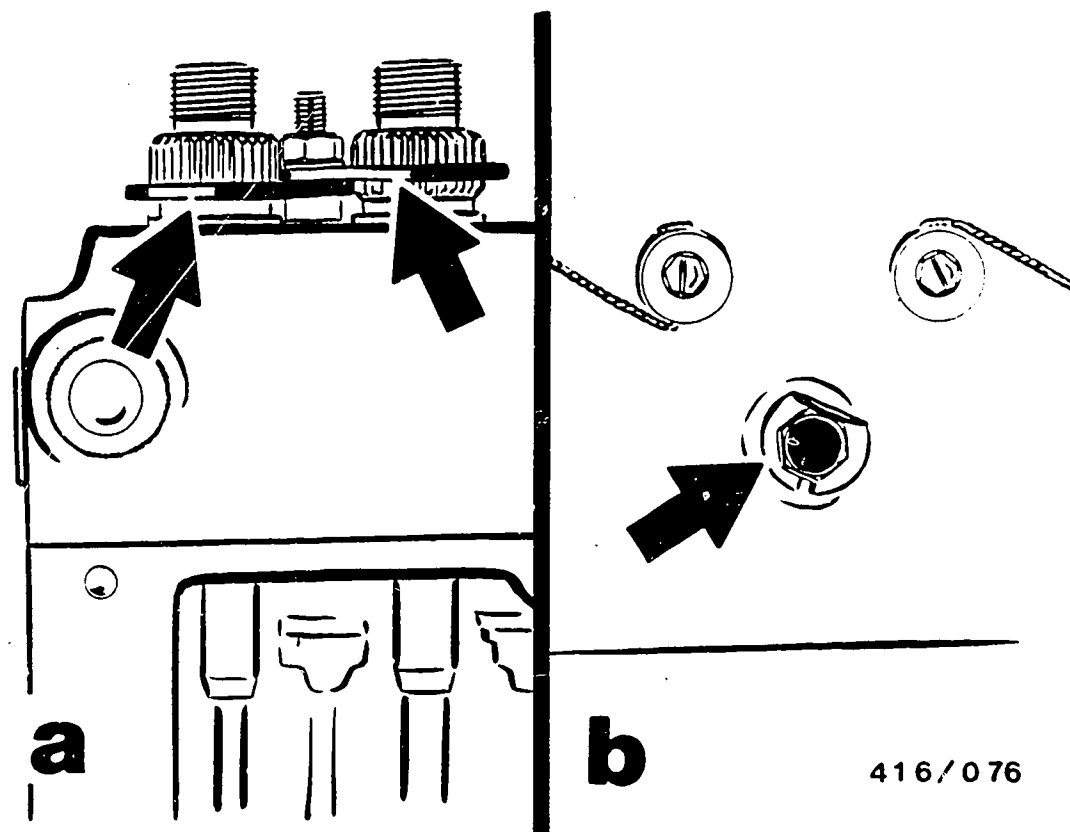
Then remove plunger return spring.



Loosen clamping screw of gear segment (picture, arrow).

Using mounting tool KDEP 1652, pull control sleeve out of gear segment and remove it through hole in base.

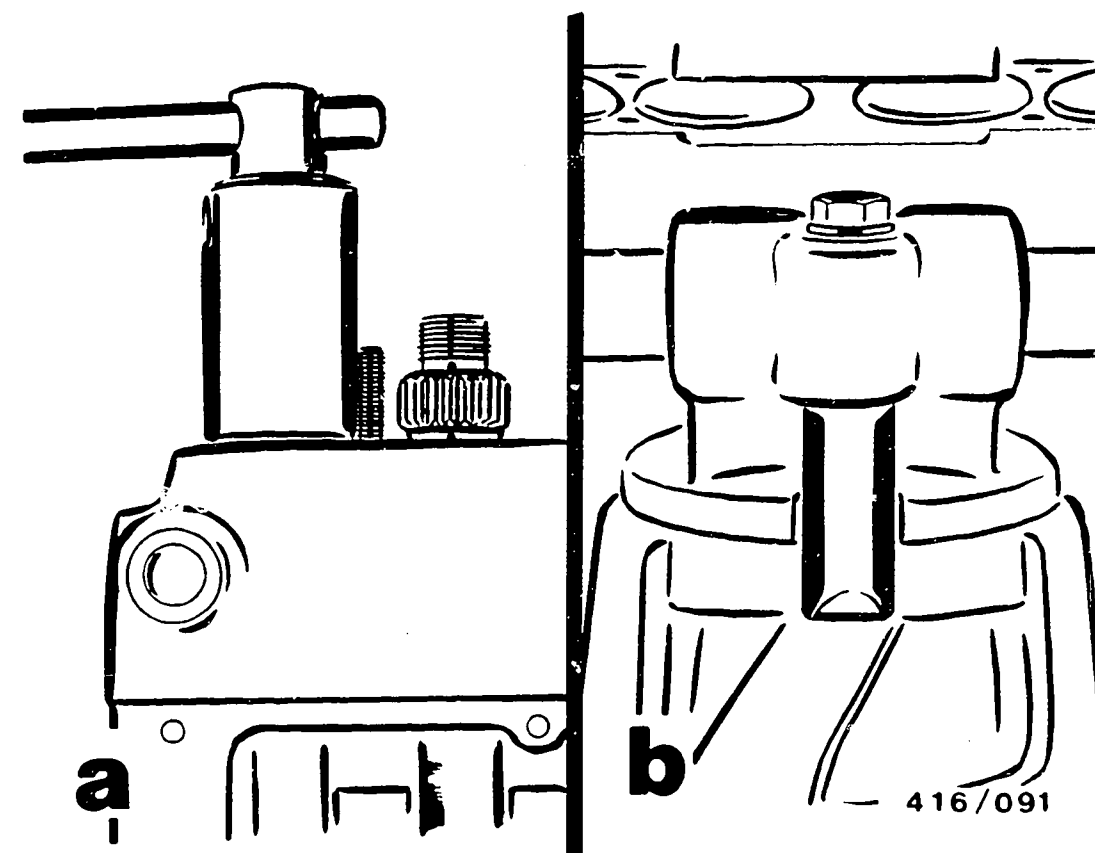
Remove gear segment.



Remove straps at delivery-valve holders (picture a, arrows).

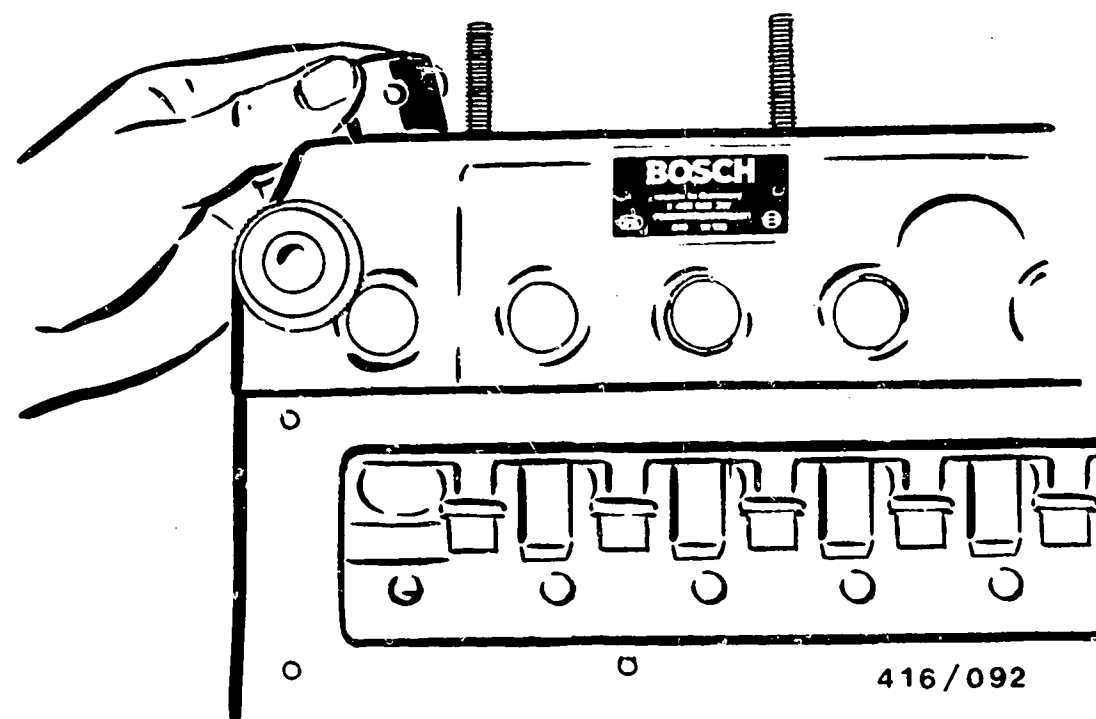
Remove control-rod positioning screw (picture b, arrow).

Pull control rod out of pump housing.



Unscrew delivery-valve holder with serrated wrench KDEP 2920 (picture a).

If delivery-valve holders are extremely tight, the top part of the clamping support is to be additionally secured against turning (picture b) with the aid of the long bushing KDEP 2919/1/14 (special accessory). Remove delivery-valve assemblies using valve lifter KDEP 2978.



Press pump barrel upwards out of pump housing (paying attention to O-ring) and place it in respective compartment in box.

Note:
Pump barrel and pump plunger must not be mixed up on account of their accuracy of fit (ground as a pair).

CLEANING PARTS

Wash out parts in a commercially available cleaning agent, e.g. chlorothene NU, which is not readily flammable and then blow out with compressed air.

Pay attention to the following safety precautions! Order Governing Work Involving Combustible Liquids (Vbf) as issued by the Federal Labor Ministry (BmA). Safety regulations for the handling of chlorinated hydrocarbons

for companies

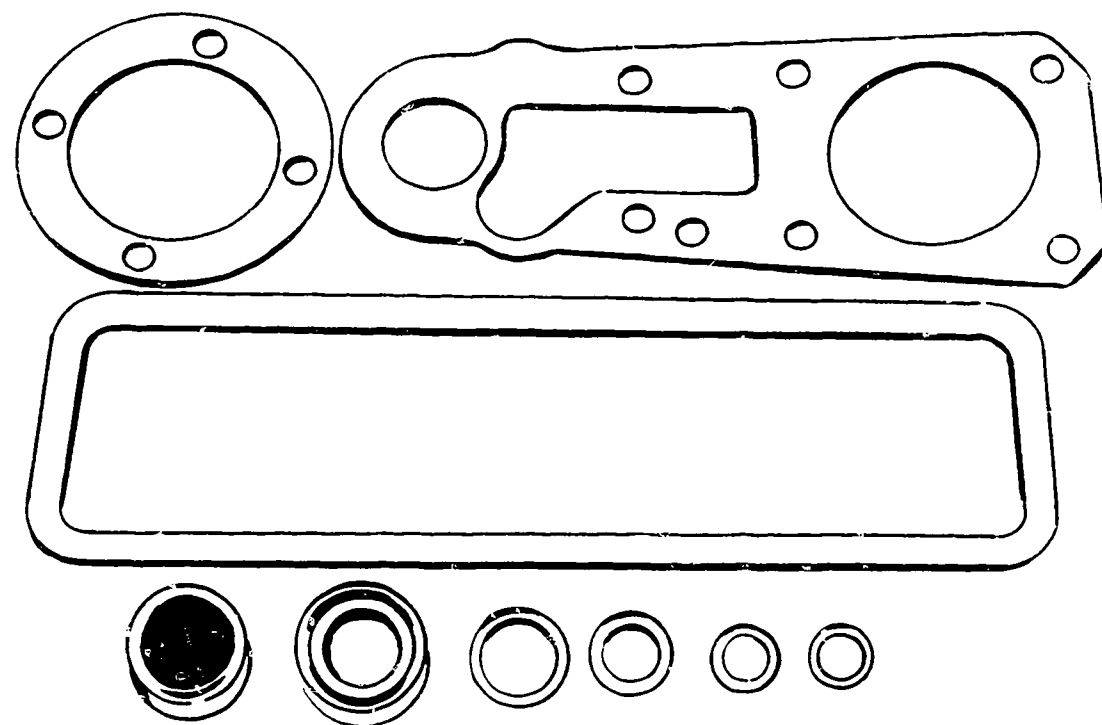
ZH 1/222

for employees

ZH 1/129

as issued by the Hauptverband für Gewerbliche Berufsgenossenschaften (Zentralverband für Unfallschutz und Arbeitsmedizin) Langwartweg 103, 5300 Bonn 5, West Germany.

Outside West Germany, attention is to be paid to the corresponding local regulations.

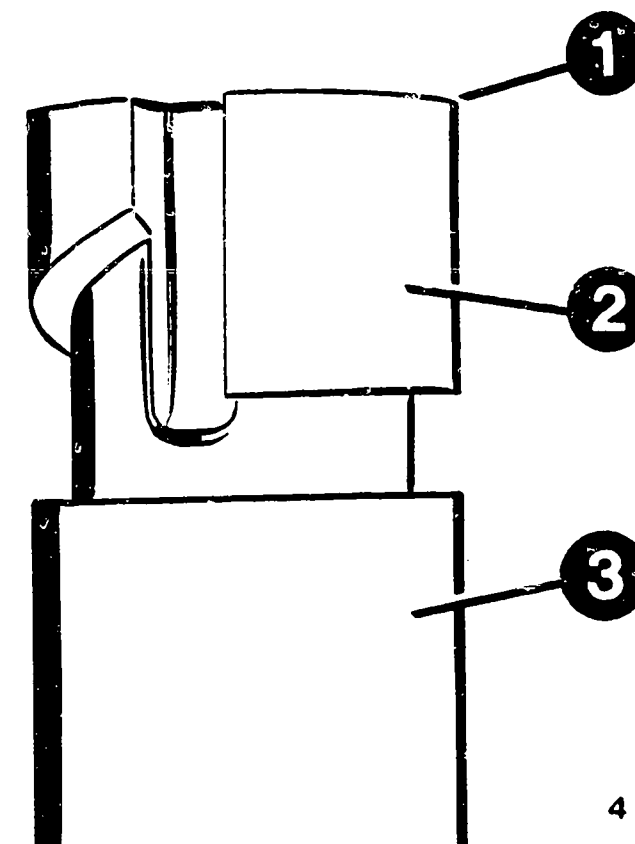


410/105

COMPONENT TESTING

Renew worn or damaged parts.

A l w a y s renew flat seal rings, radial-lip-type oil seals, O-rings and copper seal rings.



410/106

- 1 = Helix
- 2 = Head area
- 3 = Bearing surface

Test plunger-and-barrel assemblies

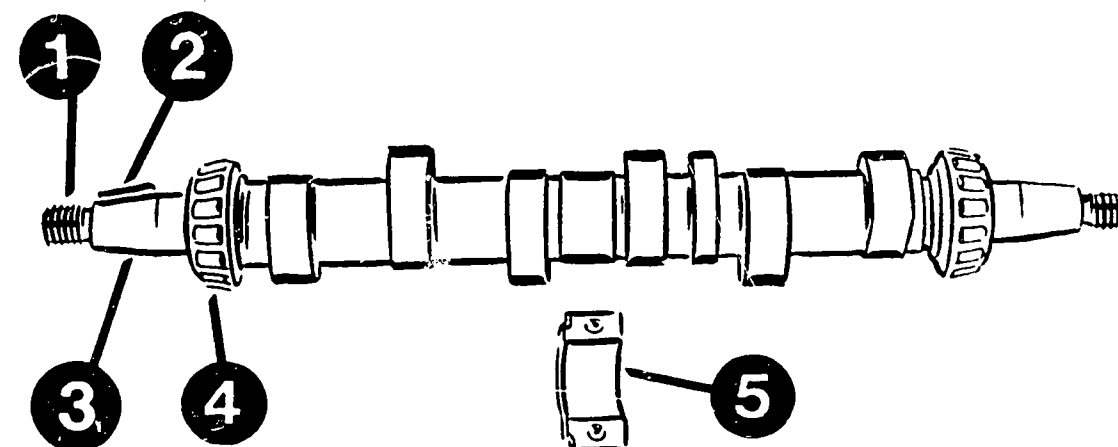
Renew plunger-and-barrel assemblies if they reveal the features listed below:

- rounded helices
- matt areas in head area
- running marks at bearing surfaces
- sticking plunger-and-barrel assemblies
(can be established by way of slide test).

Note:

Wash out plunger and barrel in calibrating oil before performing slide test on plunger-and-barrel assembly. Hold pump plunger and pump barrel more or less vertical. The pump plunger must slide down on account of its own weight.

When renewing plunger-and-barrel assemblies, the prestroke adjusting screw is likewise to be replaced.



410 / 108

- 1 = Thread
- 2 = Keyway
- 3 = Cone
- 4 = Camshaft bearing
- 5 = Intermediate bearing

Test camshaft

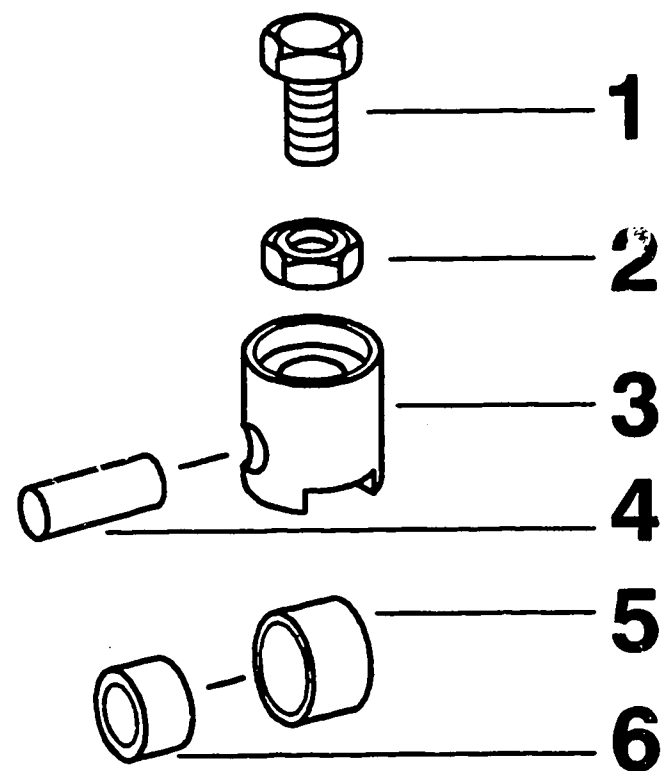
Visual inspection for:

- pronounced running marks on cams
- worn, damaged keyway
- damage to thread or cone
- worn radial-lip-type oil seals

Renew camshaft if complaint is justified.

Note:

Renew camshaft bearing and intermediate bearing as a general rule when carrying out repairs.



416/077

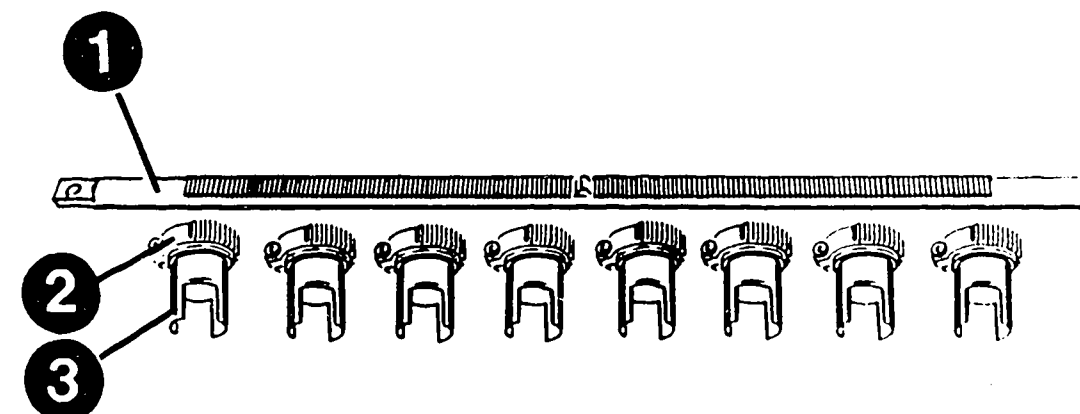
- 1 = Adjusting screw
- 2 = Lock nut
- 3 = Roller-tappet shell
- 4 = Roller
- 5 = Bushing
- 6 = Bearing pin

Renew roller tappet or individual components if following damage encountered:

- damaged adjusting screw
- pronounced running marks on roller-tappet shell
- pronounced running marks and/or discoloration at roller, bearing pin and bushing.

Note:

The adjusting screw is always to be renewed when replacing the plunger-and-barrel assembly.

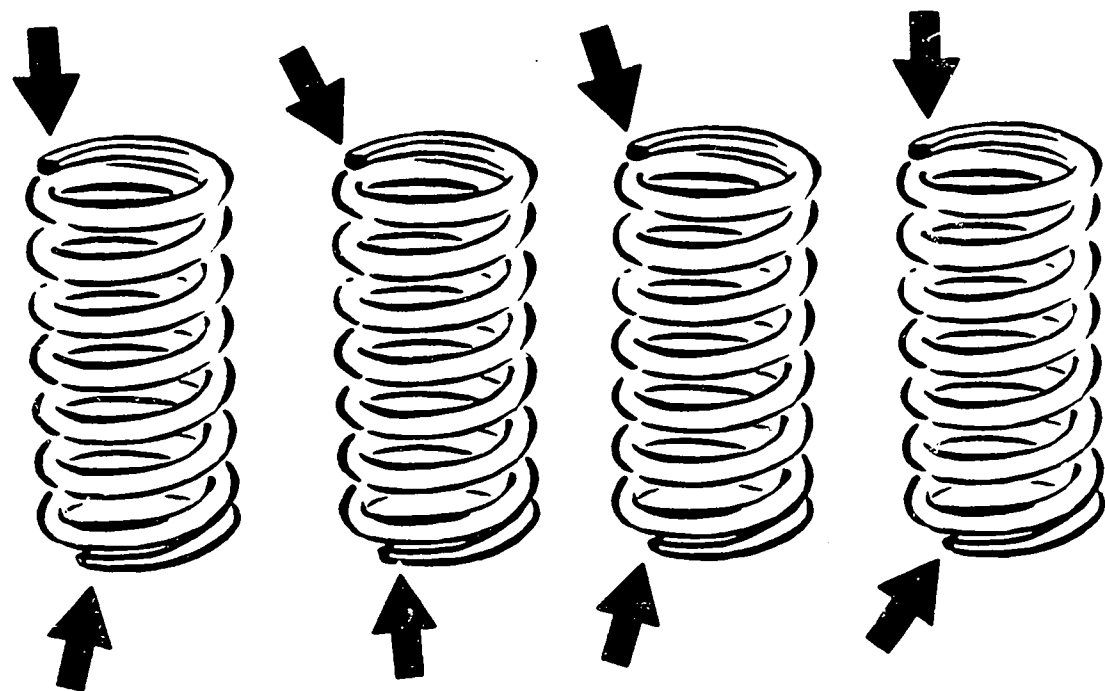


416/093

- 1 = Control rod
- 2 = Gear segment
- 3 = Control sleeve

Test control rod and control sleeves

Renew parts if gear segments/control rod in gear teeth or control sleeves in slot for plunger control arm are worn/damaged.

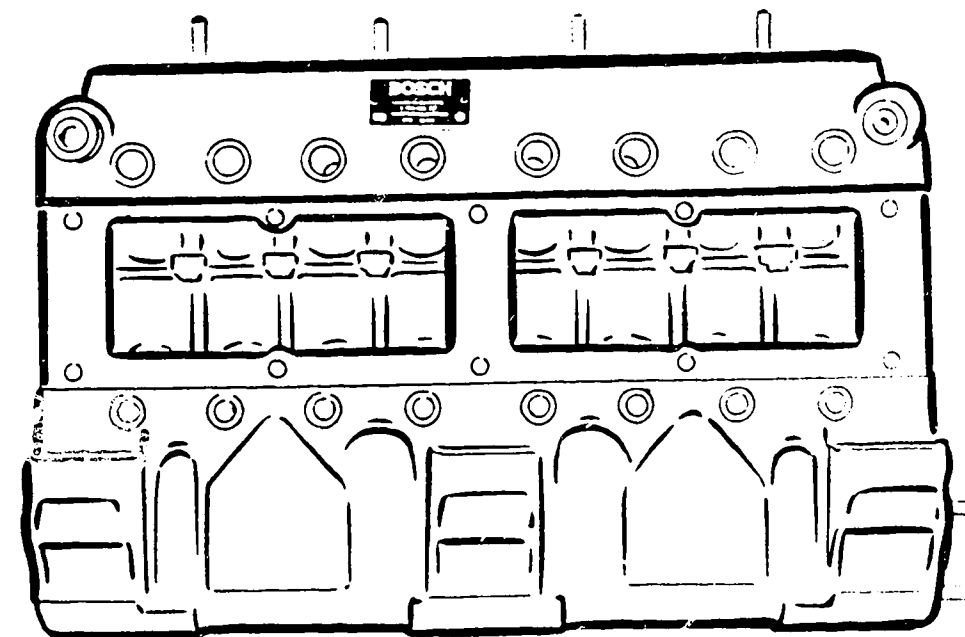


410/44

Test plunger return springs

Plunger return springs, which are corroded or whose surface is damaged, must be replaced on account of the danger of fracture.

The area of the 1st turn seating surface is to be subjected to particular testing (end turns worn; picture, arrows).



416/078

Test pump housing

Check housing for cracks and other external damage.

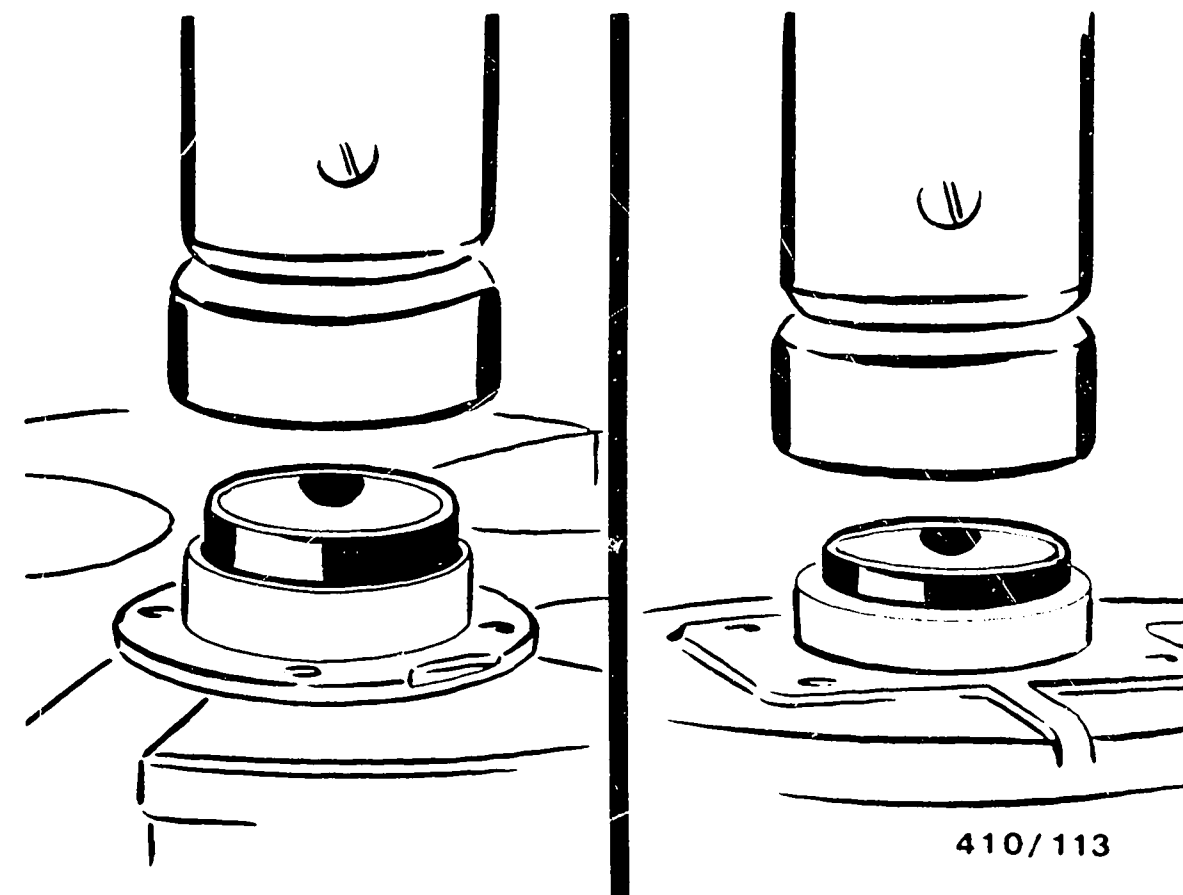
Pay particular attention to the following:

- thread at stay bolt and inserts
- scoring on roller-tappet guides
- freedom of movement of control rod in its guide
- cavitation in suction gallery
- unevenness/fuel deposits at seats for plunger-and-barrel assemblies.

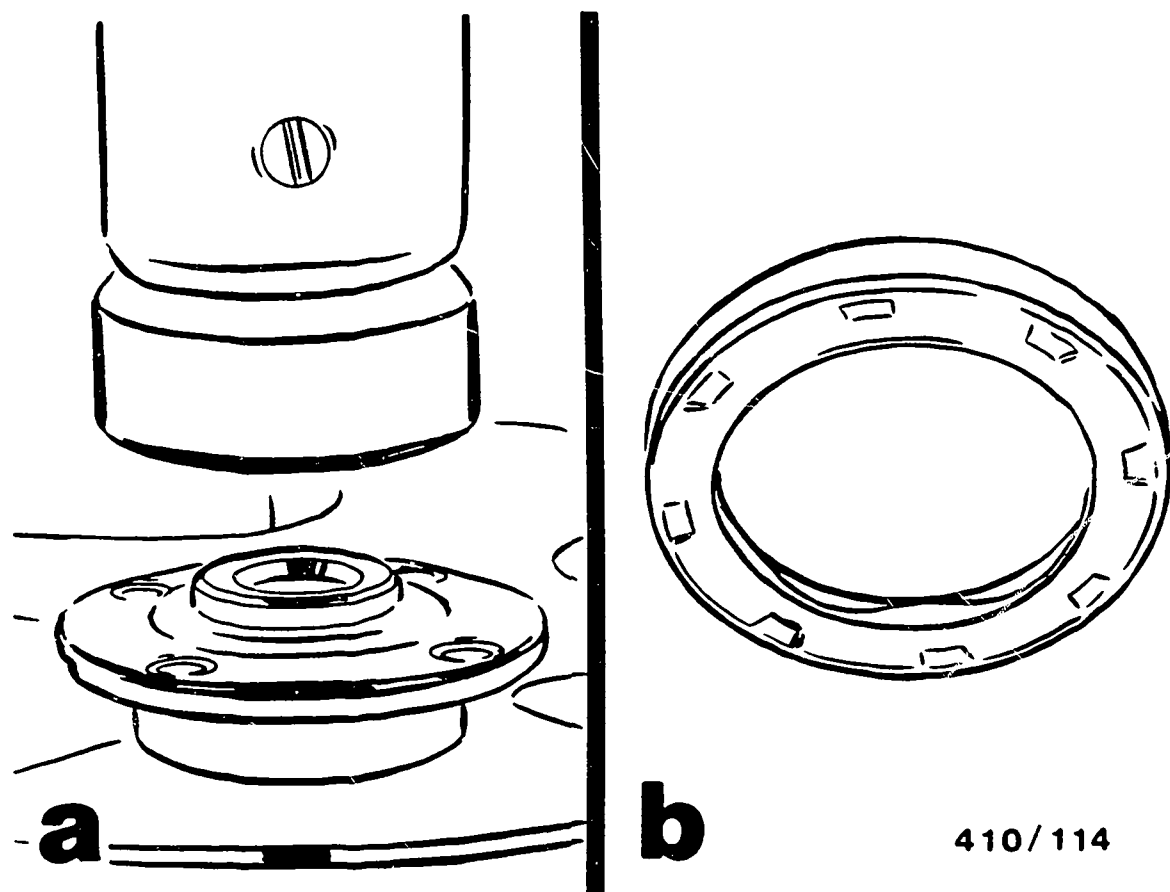
FUEL-INJECTION PUMP REPAIR

Bearing outer race renewal

Remove bearing outer races from bearing end plate with spring collet KDAW 995-22 and puller bell KDAW 9995-40.



Press new bearing outer races under mandrel press into bearing end plate as far as bearing seat (pictures a,b).



410/114

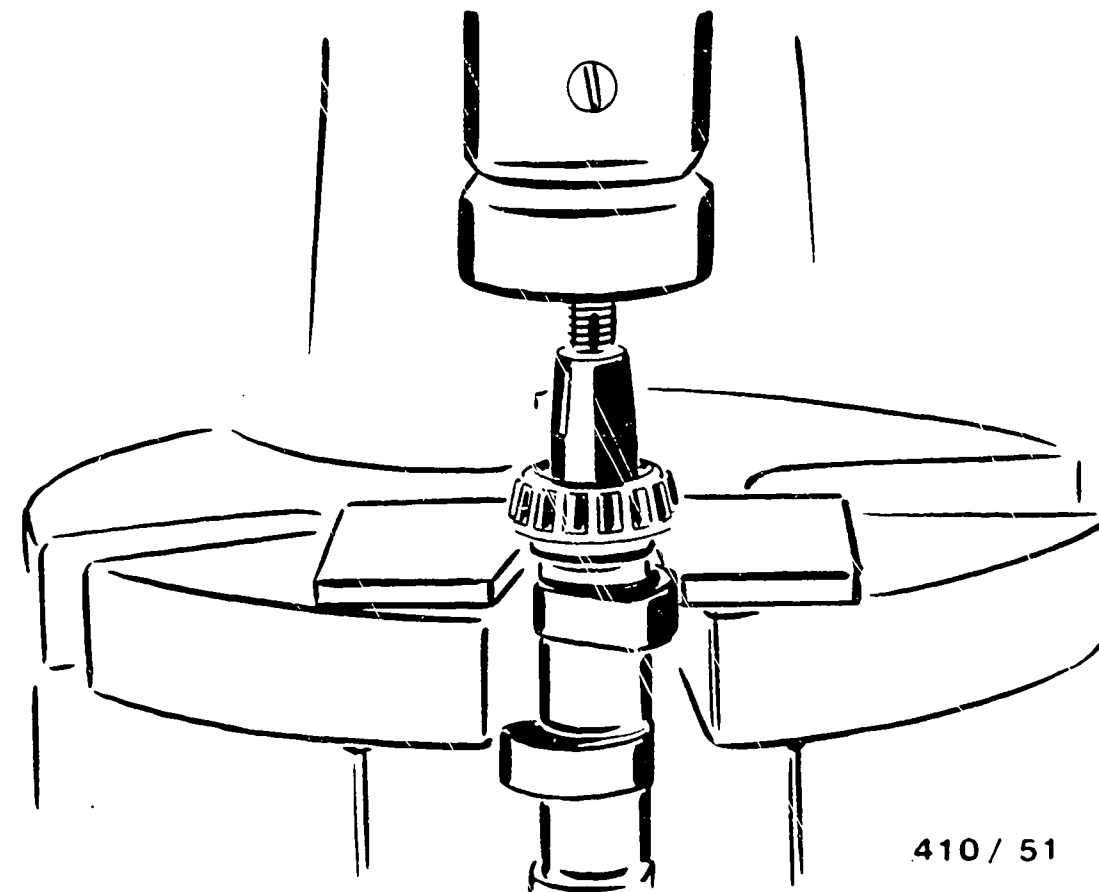
Replacement of radial seals

Apply small quantity of lubricant to outside of new radial-lip-type oil seal and press it flush into bearing end plate (picture a).

Note:

Cone and sealing surface must be grease-free when installing camshaft in the case of fuel-injection-pump versions with seal ring of the type illustrated in picture b.

Fill double-lip seal ring with high-temperature grease between sealing lips.



410/51

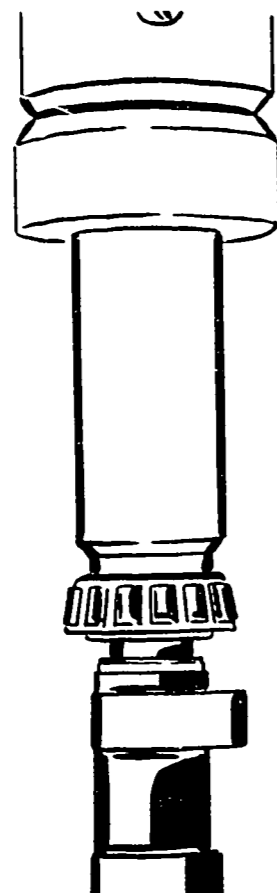
Camshaft-bearing renewal

Press off camshaft bearing under mandrel press using release plate KDEP 1580.

Note:

The release plate is suitable for all camshaft diameters.

The camshaft is therefore to be pushed into the recess until the bearing collar makes contact on either side.

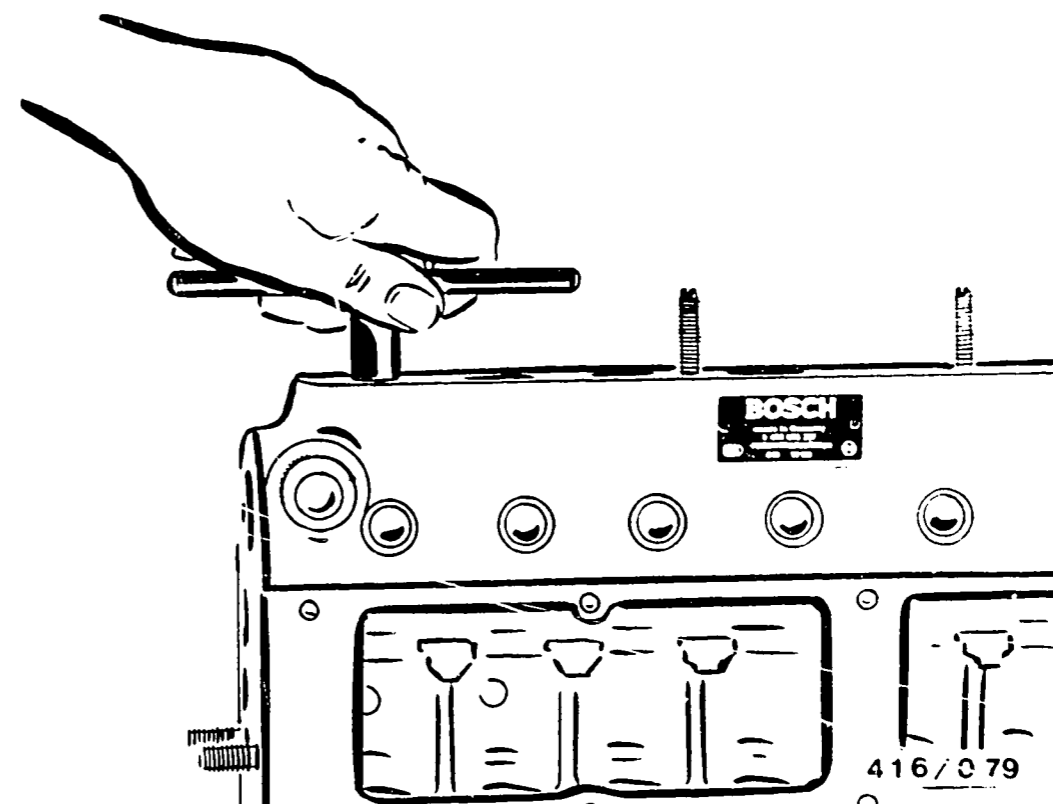


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Press on new camshaft bearings under mandrel press with pressing-on sleeve. Re-use existing shims for axial-clearance adjustment on same side.

Fit shims such that thick ring with lug faces in direction of cam.

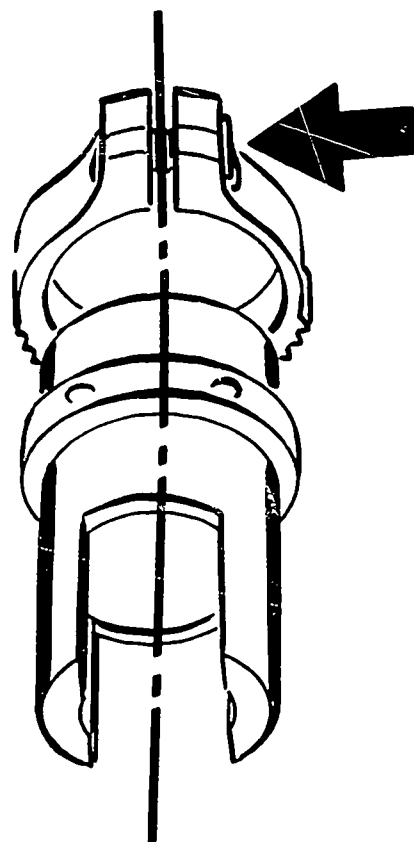
Note:
Pressing-on sleeve KDEP 1583 can be used for 30 mm cone



Reworking seats for plunger-and-barrel assemblies

Re-cut (smooth) seats for plunger-and-barrel assemblies carefully and without exerting much pressure by means of hand cutter, so as to eliminate any unevenness and/or fuel deposits. Use hand cutter KDEP 2958.

Note:
After performing the work, wash out pump housing in cleaning agent.



416 / 039

Renewal of gear segments at control sleeve

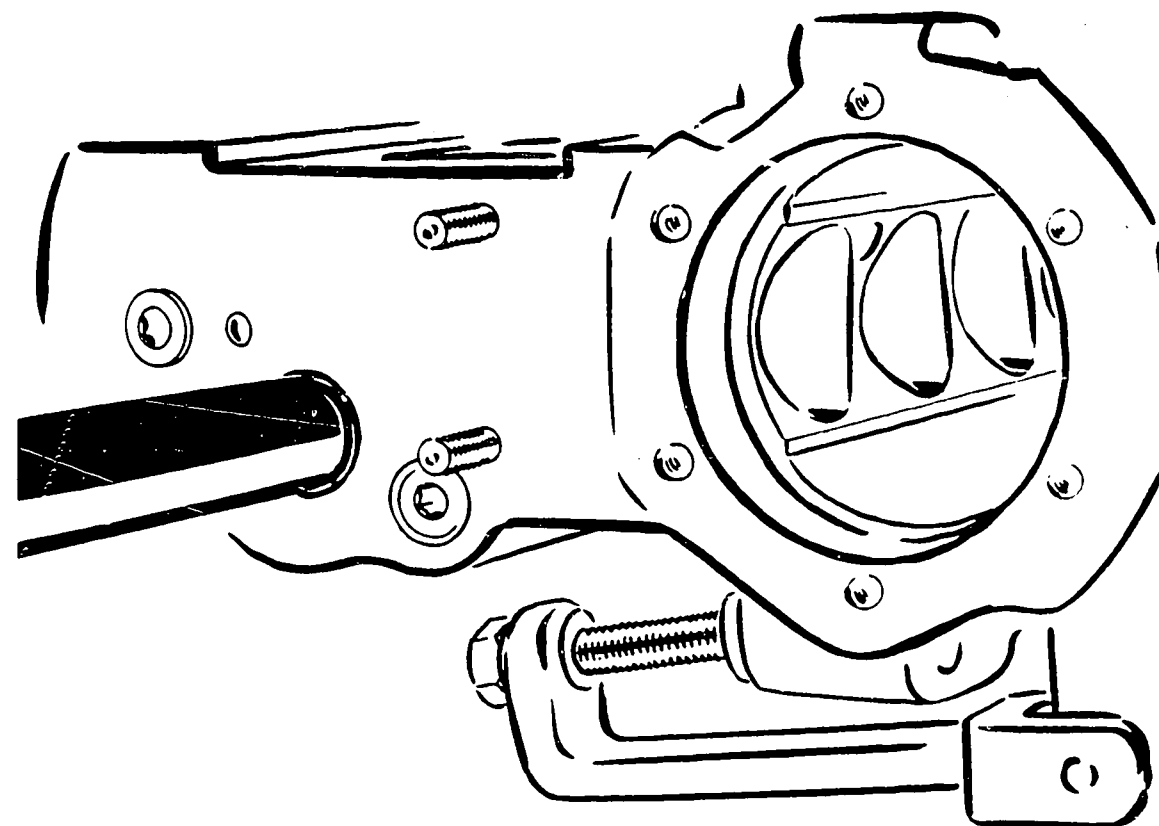
Renew worn gear segments by loosening clamping screw (picture, arrow).

Fit new gear segment centrally on control sleeve (picture).

Holes for turning control sleeve must face forwards.

Note:

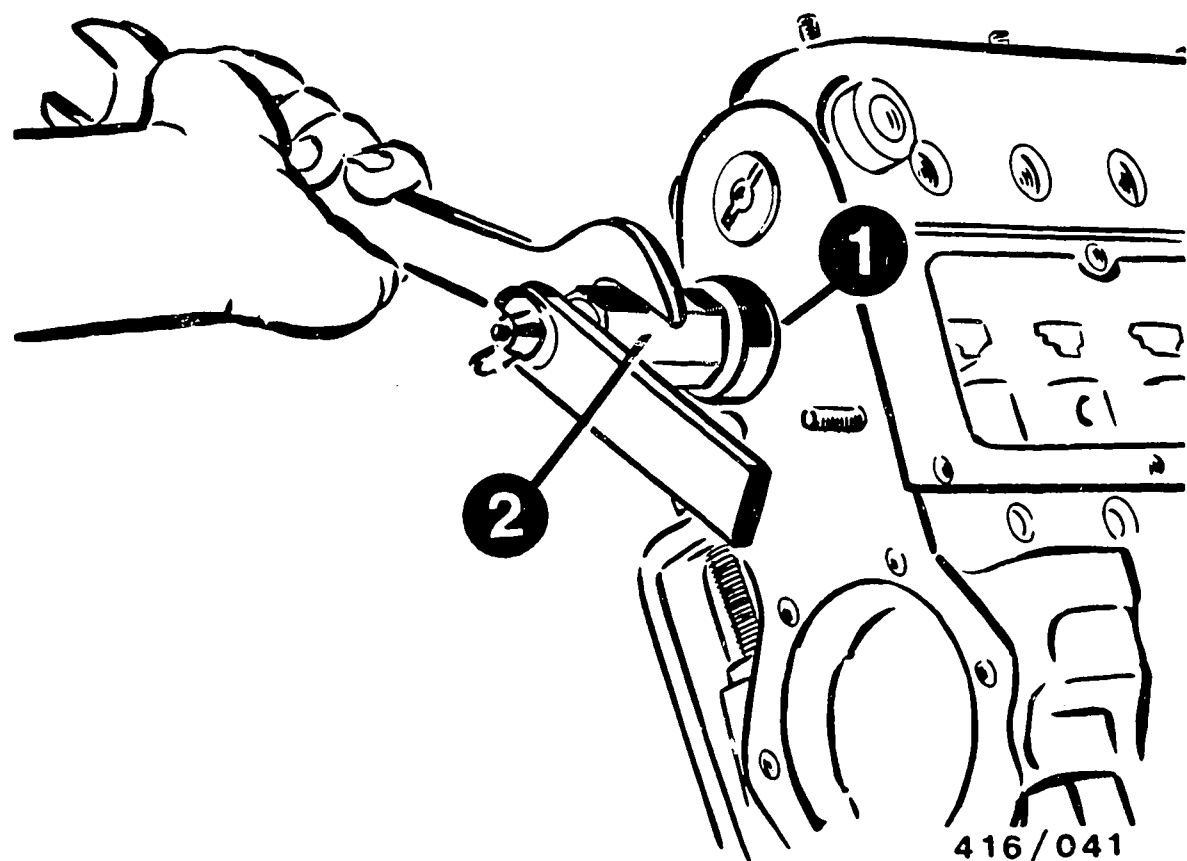
After tightening the clamping screw, the cheeks of the gear segment must not make contact with one another.



416 / 040

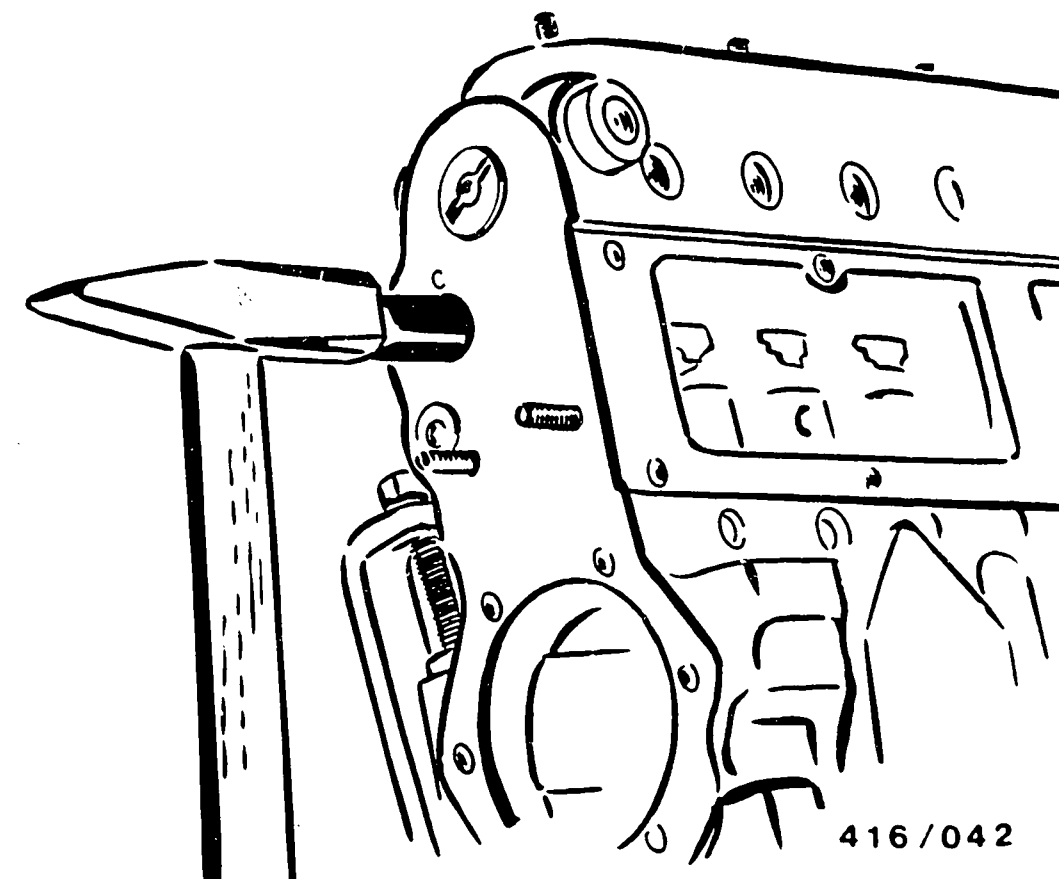
Renewal of worn control-rod guide bushings

Use KDEP 2970 to remove threaded bushing.



1 = Base support KDEP 1654
2 = Puller KDEP 1056

Use puller KDEP 1056 to remove the two control-rod guide bushings.



Knock new guide bushings into pump housing with press-in mandrel KDEP 1655.

Clamp on pump housing.

Use reamer KDEP 1622 and guide sleeve to ream control-rod guide bushing to control-rod diameter.

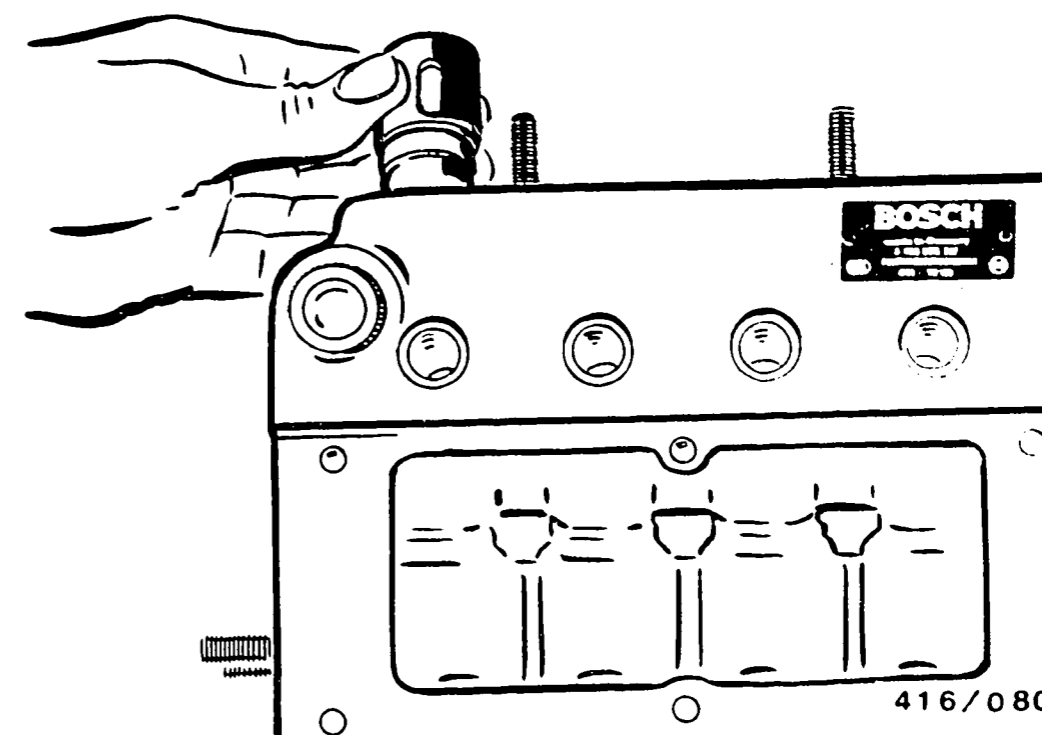
Note:

After reaming the guide bushings, insert the control rod without twisting it, turn it to 360° and slide it in.

It must be possible to move the control rod freely without it jamming.

The guide bushings are to be re-reamed if necessary.

Thoroughly wash out pump housing.



FUEL-INJECTION PUMP ASSEMBLY

Clamp on injection-pump housing.

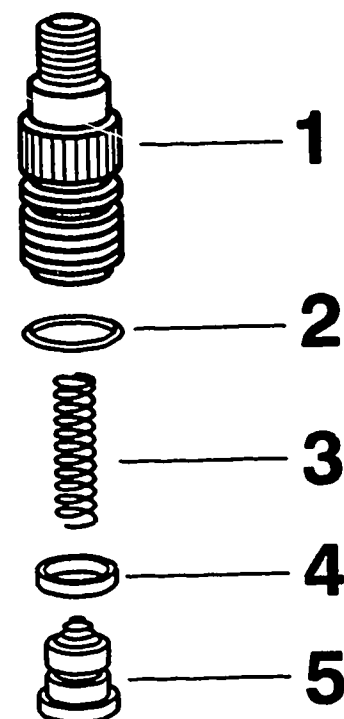
When performing subsequent operations, exclusive use is to be made of cleaned, non-worn and non-damaged components.

Pump-barrel installation

Insert O-ring into pump housing beneath guide pin.

Apply small quantity of grease to bevel of pump barrel.

Insert pump barrel in housing such that positioning pin engages in guide groove. This ensures that the barrel cannot turn.



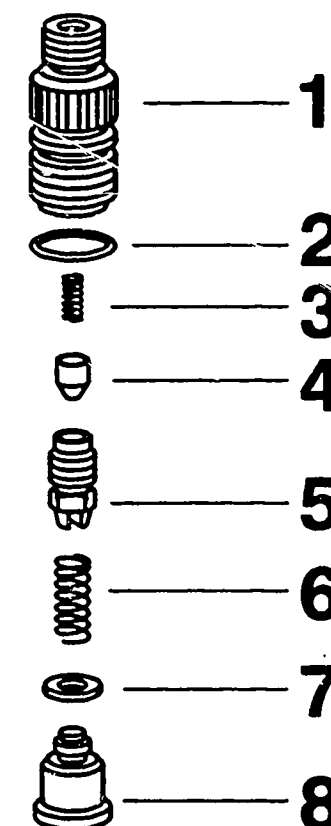
416/081

- 1 = Delivery-valve holder
- 2 = Seal ring
- 3 = Pressure spring
- 4 = Seal ring
- 5 = Delivery-valve assembly

Install delivery-valve assemblies.
Delivery-valve holders w i t h o u t return-flow restriction.

Assemble delivery-valve assemblies in correct sequence.
Screw in delivery-valve holders (renew seal ring).
Tighten delivery-valve holders with serrated wrench KDEP 2920 to prescribed tightening torque.
Pay attention to t i g h t e n i n g s e q u e n c e .

Tightening torque:
120-0-90...95

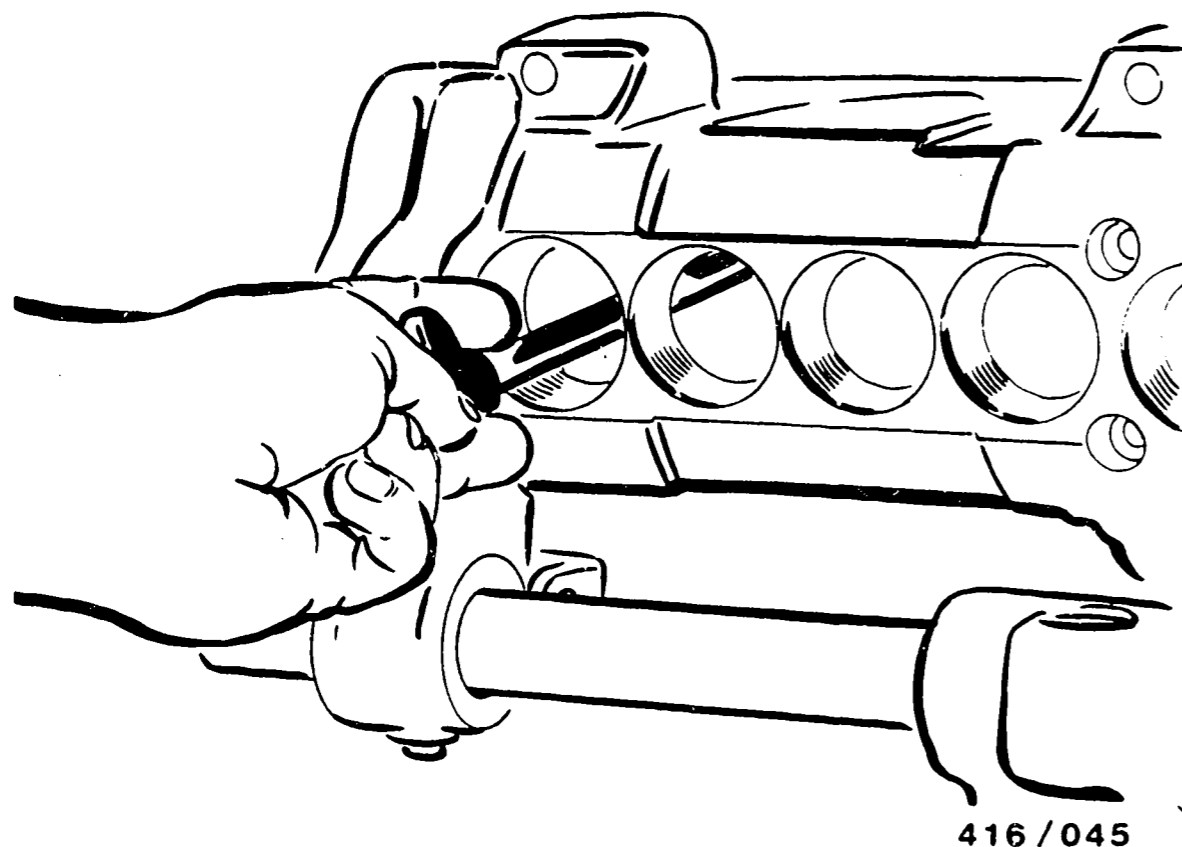


416/082

- 1 = Delivery-valve holder
- 2 = Seal ring
- 3 = Pressure spring
- 4 = Valve cone
- 5 = Screw plug
- 6 = Pressure spring
- 7 = Seal ring
- 8 = Delivery-valve assembly

Installing delivery-valve assemblies
Delivery-valve holders w i t h return-flow restriction

Check tightness of screw plug in delivery-valve holder.
Assemble delivery-valve assemblies in correct sequence.
Screw in delivery-valve holders (renew seal ring).
Tighten delivery-valve holders with serrated wrench KDEP 2920 to prescribed tightening torque.
Pay attention to t i g h t e n i n g s e q u e n c e .
Tightening torque:
120-0-90...95



Suction-gallery leak test

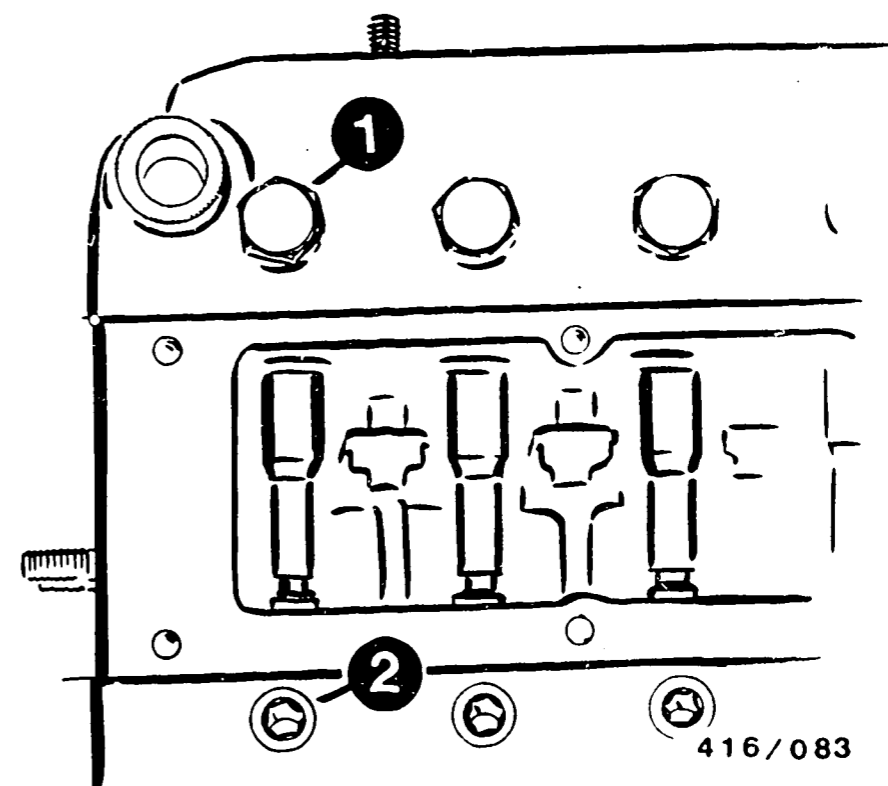
Preparation:

Tilt housing (approx. 90°)

Moisten pump plunger with calibrating oil and insert it in pump barrel using plunger grippers KDEP 2942. Check to see that pump plunger moves freely.

Note:

If it does not move freely, remove plunger-and-barrel assembly and re-cut (smooth) seat for plunger-and-barrel assembly.



1 = Baffle screw

2 = Screw (M 10 x 45)

Screw in fastening screws and tighten to prescribed tightening torque.

Hexagon bolt	M 10	25...30 Nm
	M 14	40...45 Nm

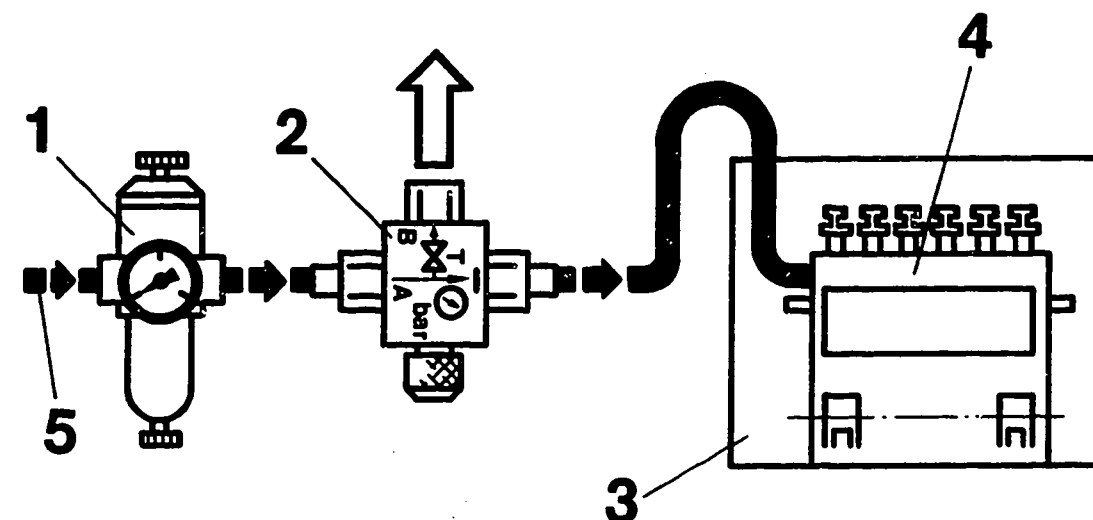
Screw in screws (M10 x 45, cut thread) to restrict lift of pump plunger.

Unscrew housing from clamping support.

Before immersing it in calibrating oil, connect pump housing via pressure regulator with water separator to compressed-air network.

To effect prescribed reduction in pressure during leak test, fit directional-control valve KDJE-P-100/1 of pressure measuring device KDJE-P 100 in compressed-air inlet.

Seal unused fuel inlet connections.



410/128

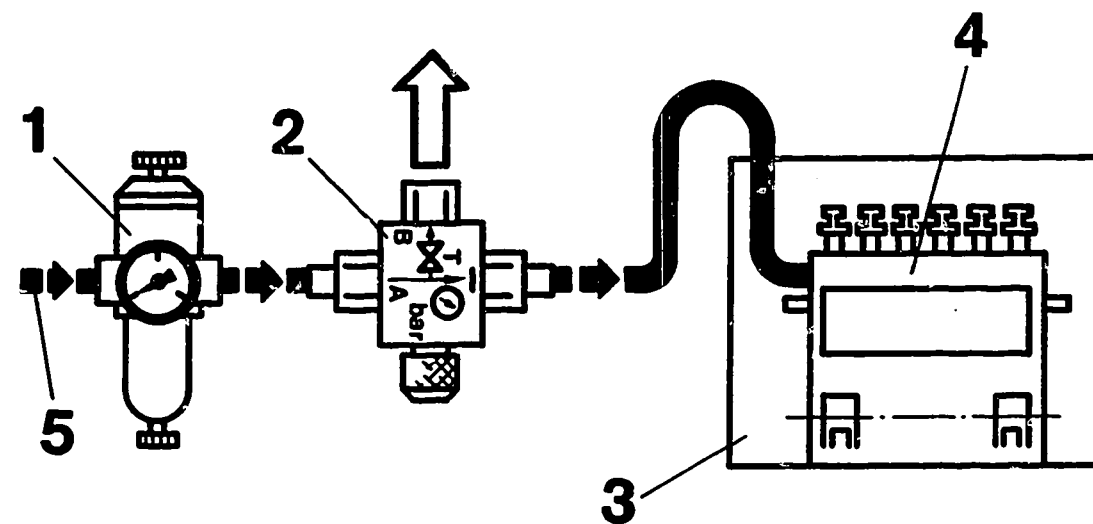
- 1 = Pressure regulator with pressure gauge 0...6 bar and water separator
- 2 = Directional-control valve KDJE-P 100/1
- 3 = Immersion bath containing calibrating oil
- 4 = Fuel-injection pump
- 5 = Compressed air

Suction-gallery test

Immerse housing in test bath, spring chamber faces upwards.

Leaks in the area of the suction gallery are not permitted. Pay particular attention to leakproofness of O-ring seals.

Leaks between barrel and plunger are an exception. Leaking delivery-valve assemblies are to be replaced.



410/128

- 1 = Pressure regulator with pressure gauge 0...6 bar and water separator
- 2 = Directional-control valve KDJE-P 100/1
- 3 = Immersion bath containing calibrating oil
- 4 = Fuel-injection pump
- 5 = Compressed air

Test time and test pressure:
min. 1 minute at 5 bar

In the event of a leaking plunger-and-barrel assembly seat, unscrew delivery-valve holder, remove assembly cylinder and carefully re-cut sealing surface in housing with KDEP 2958.

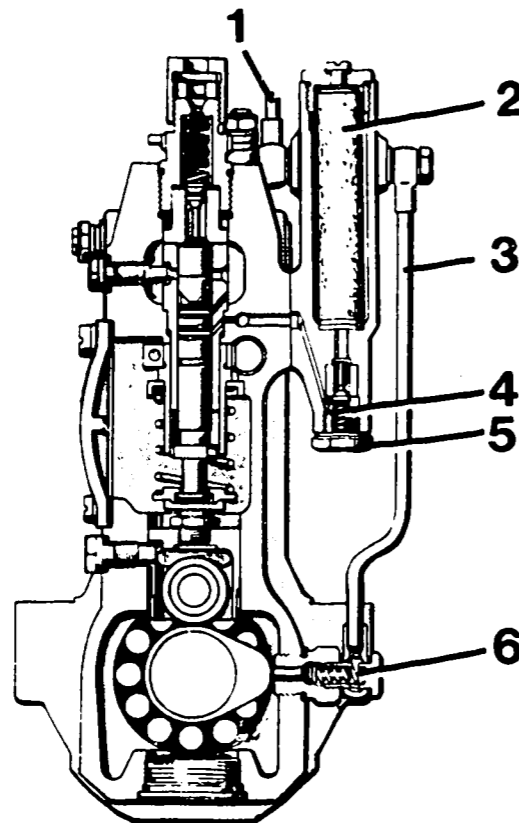
Clean housing. Insert assembly cylinder and assembly plunger, screw in delivery-valve holder and tighten to prescribed torque.

Repeat leak test.

Note:

To avoid skin irritation, apply hand cream to hands beforehand and wash with soap and water after completing test.

Remove compressed-air connection at pump housing.

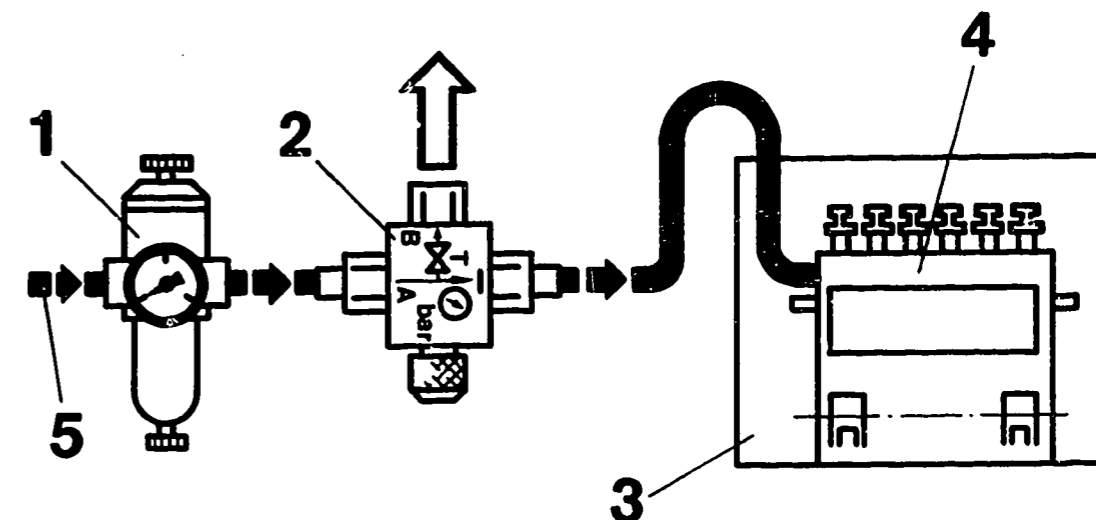


416/084

- 1 = Oil-supply line
- 2 = Oil-block filter
- 3 = Connecting line
- 4 = Non-return valve
- 5 = Screw plug
- 6 = Oil-supply valve

Check leakage-fuel block for leaks

Remove connecting line.
 Seal connection for oil-supply line.
 Remove valve cone from non-return valve.
 Seal oil-block filter with screw plug.



410/128

- 1 = Pressure regulator with pressure gauge 0...6 bar and water separator
- 2 = Directional-control valve KDJE-P 100/1
- 3 = Immersion bath containing calibrating oil
- 4 = Fuel-injection pump
- 5 = Compressed air

Connect pressure regulator to oil-block filter.
 Immerse head end of pump in immersion bath such that assembly cylinders are washed around approx. 10...15 mm below end of cylinder.

Test time and test pressure: 1 min. at 5 bar.

No air may emerge between assembly cylinder and pump housing.

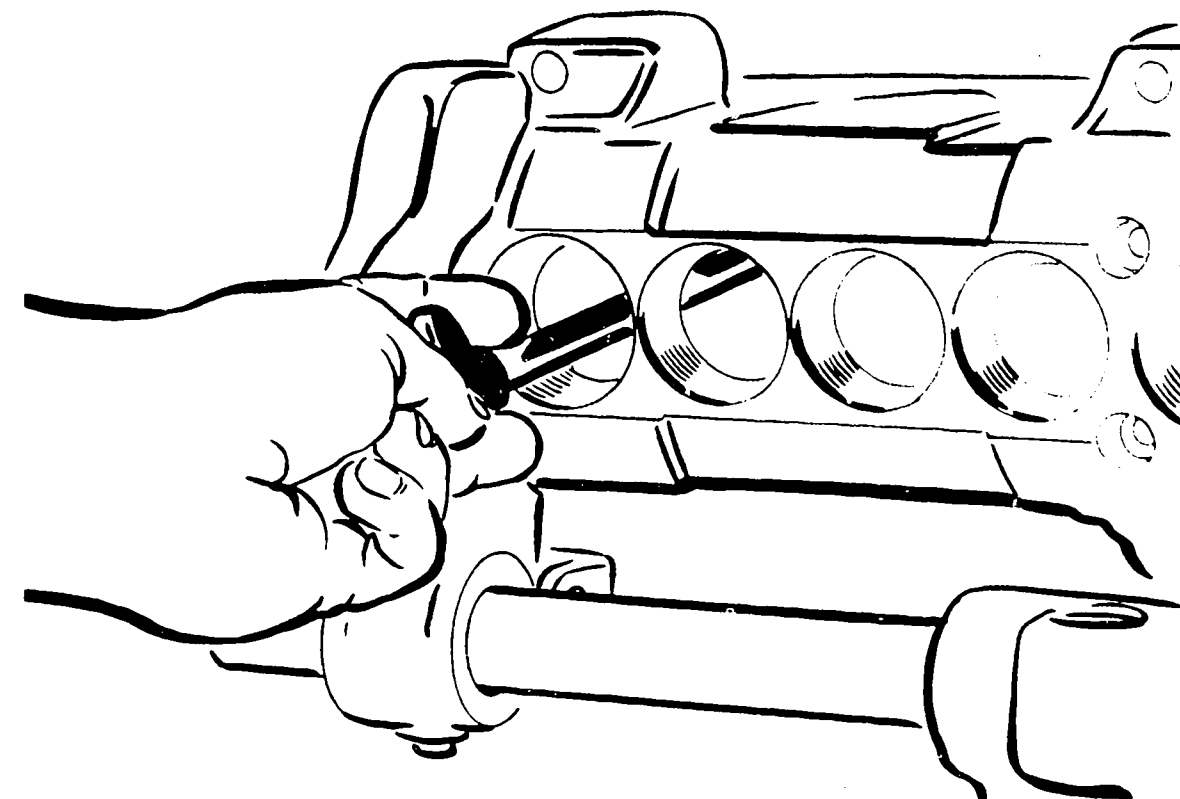
In the event of leaks, unscrew delivery-valve holder,
remove assembly cylinder.
Renew O-ring.

Insert assembly cylinder.
Tighten delivery-valve holder to prescribed torque.

Repeat leak test.

Note:

In order to prevent skin irritation, grease hands with
hand cream beforehand and wash with soap and water after
completing test.



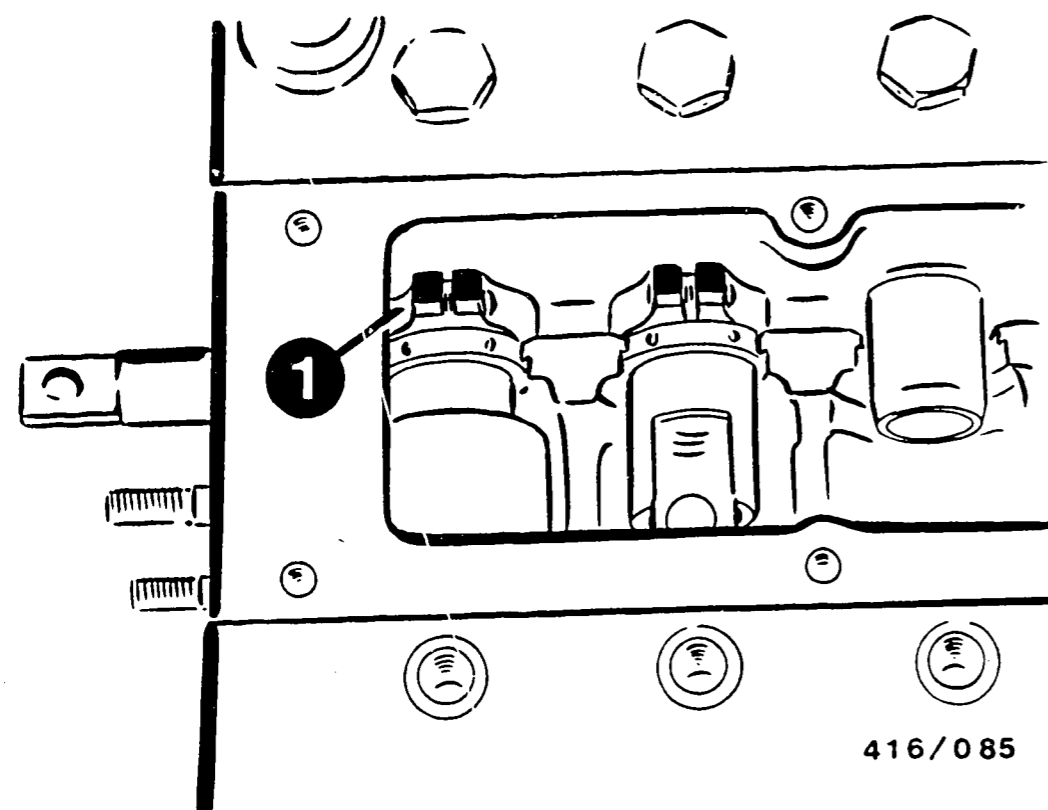
416 / 045

Remove compressed-air connection at pump housing.

Clamp on and tilt pump housing.

Remove screws.

Use plunger grippers KDEP 2942 to remove pump
plunger from pump barrel and place it in respective
barrel-assembly tray.



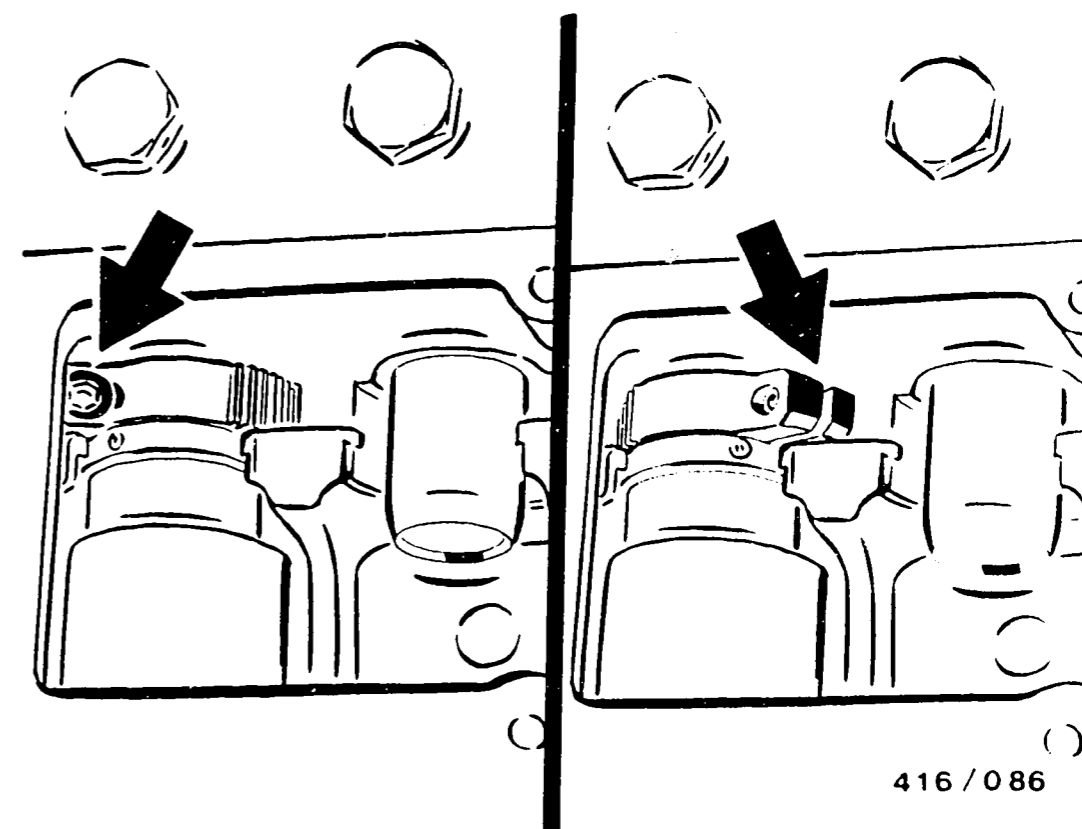
1 = Gear segment

Fitting control rod and control sleeves

Insert control rod into pump housing. Screw in positioning screw, tighten to 5...6 Nm and secure.

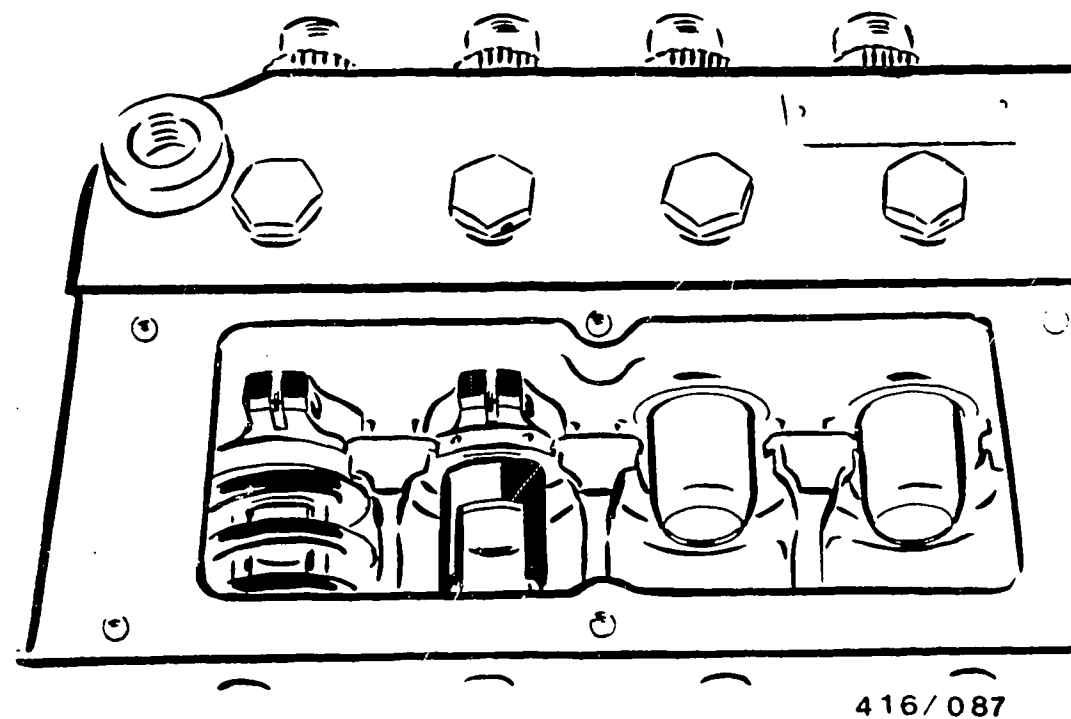
Move control rod to center position.

Using mounting tool KDEP 1652, insert control sleeve with gear segment into control rod.

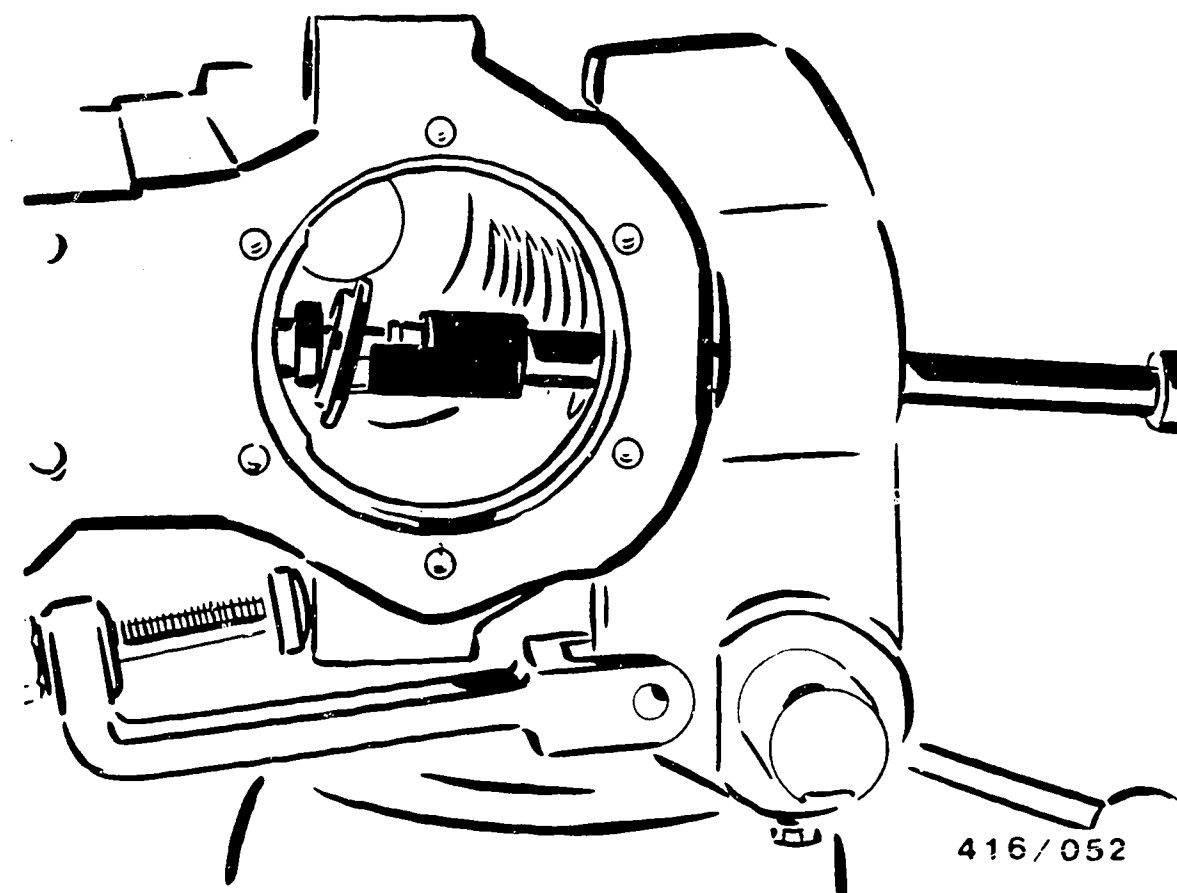


Actuate control rod from stop to stop and check whether clamping jaw of gear segment is the same distance from housing collar (picture, arrows) in both end positions.
If this is not the case, move control rod to center position and fit control sleeve again.

Insert remaining control sleeves in same position. Then check all gear segments for same left-hand and right-hand stop.



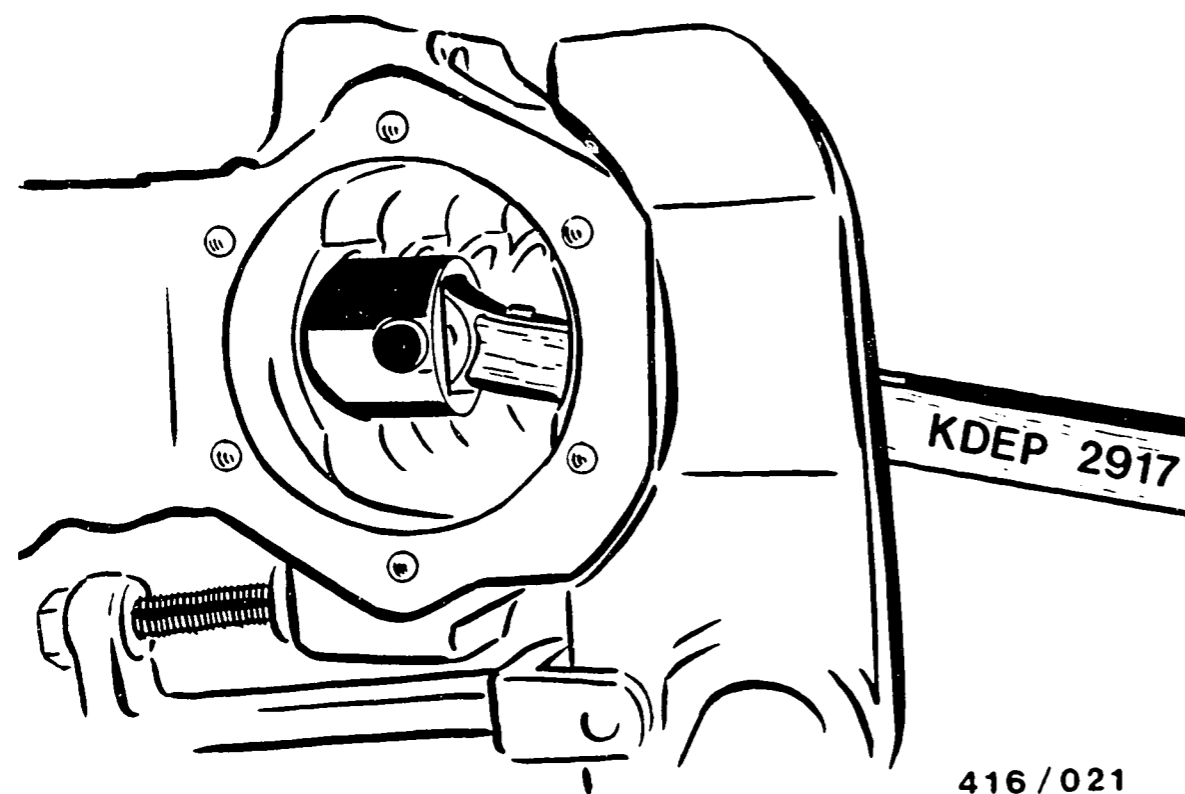
Fit pump plunger and roller tappet.
Install upper spring seat and plunger return spring.



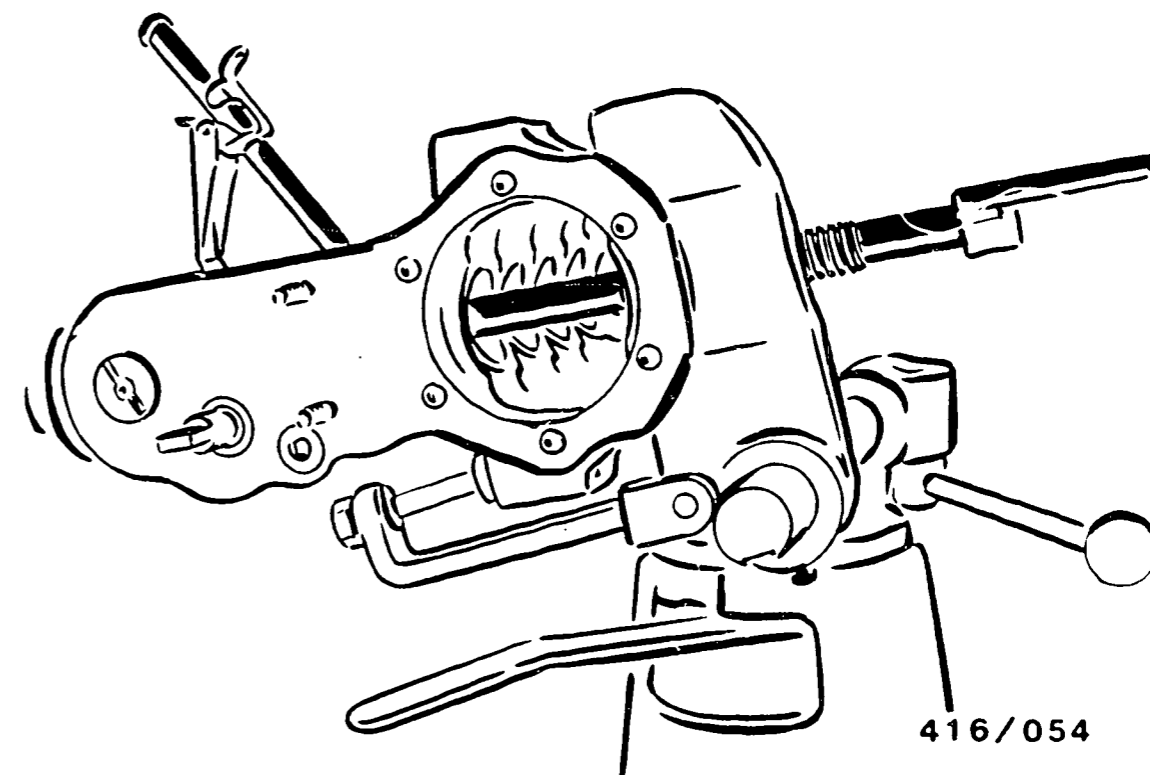
Moisten pump plunger with calibrating oil and insert with plunger grippers KDEP 2942 and lower spring seat in pump barrel.

Check pump plunger for freedom of movement.

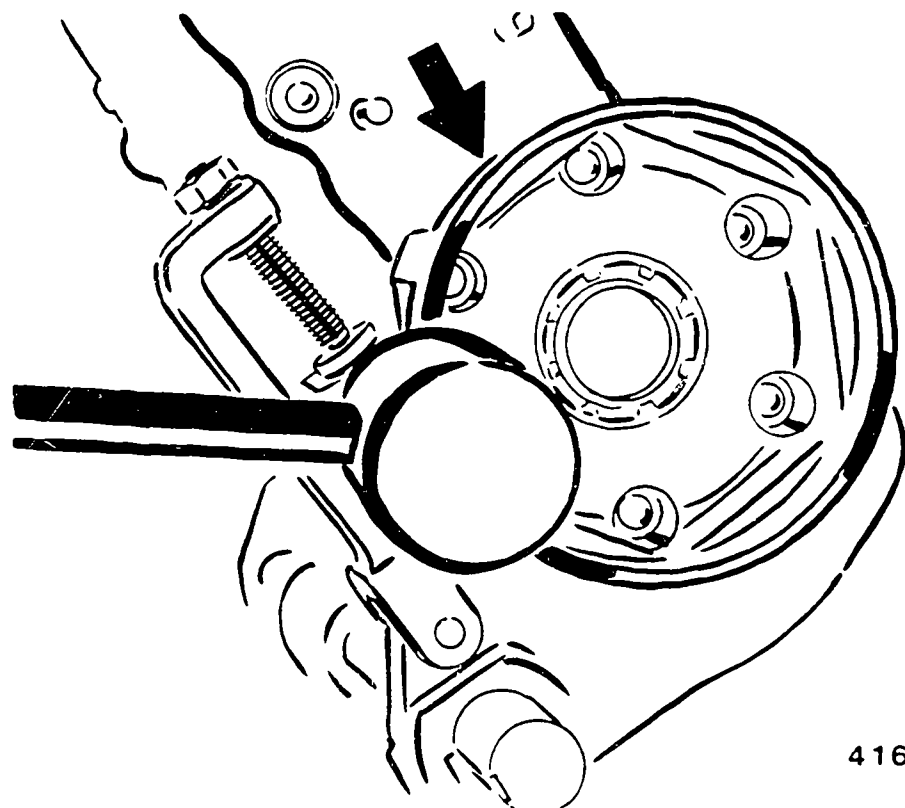
Note:
The index notch on the plunger control arm must point upwards towards the spring-chamber closing cover on insertion.



Insert roller tappet with tappet forceps KDEP 2917 into camshaft chamber. Guide groove in roller-tappet shell must face upwards.



Use clamping fixture KDEP 1536 to press roller tappet against plunger return spring and fix in upper position with tappet holder KDEP 1621. **C a u t i o n .** Insert plunger carefully into control sleeve.



416/088

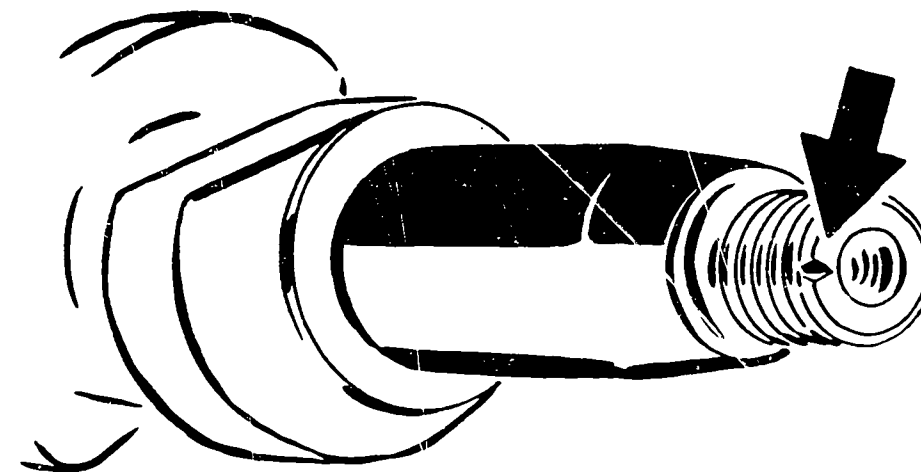
Camshaft installation

Apply a small quantity of grease to O-ring on drive-bearing end plate.

Apply sealing compound to contact surface of bearing end plate (surface sealing compound 5 970 100 512; picture, arrow).

Drive bearing end plate into housing using plastic hammer.

Tighten fastening screws with tightening torque of 15...18 Nm (M6) or 20...24 Nm (M8).



410/135

Before fitting camshaft, pay attention to index notch which is only to be found on one side of the two threaded shaft ends (picture, arrow).

The installation position of the mark determines the correct cam sequence and can be seen from the assembly number of the fuel-injection pump.

Note:

In the case of differing cone diameters, the larger diameter faces the drive end.

Explanation of assembly numbers

Supply pump (attachment side and number)														Governor on pump side 1)	Timing device on pump side	Plunger helix	
Attached to:																Lower	Upper
Pump side 3 Pump side 4 Pump sides 3 and 4																	
Without	1 x	2 x	1 x	2 x	1 x	2 x	1 x	2 x	1 x	2 x	1 x	2 x	1 x				
Shaft position (indicated by notch at shaft end)																	
1	2	1	2	1	2	1	2	1	2	1	2	1	2				
100	200	300	400	500	600	700	800	900	1000					—	—		
101	201	301	401	501	601	701	801	901	1001					—	1		
102	202	302	402	502	602									—	2	left-hand	right-hand
110	210	310	410	510	610									1	—		
112	212	312	412	512	612									1	2		
120	220	320	420	520	620	720	820	920	1020	1320		1520		2	—	right-hand	left-hand
121	221	321	421	521	621	721	821	921	1021					2	1		

Example: 421

Fuel-injection pump with shaft position 2 and supply pump on pump side 3, governor on pump side 2 and timing device on pump side 1.

A code number for the supply-pump attachment possibility can be added on to the assembly number, e.g.:
../3 = with attachment hole for supply pump, sealed by means of cover (without supply pump).

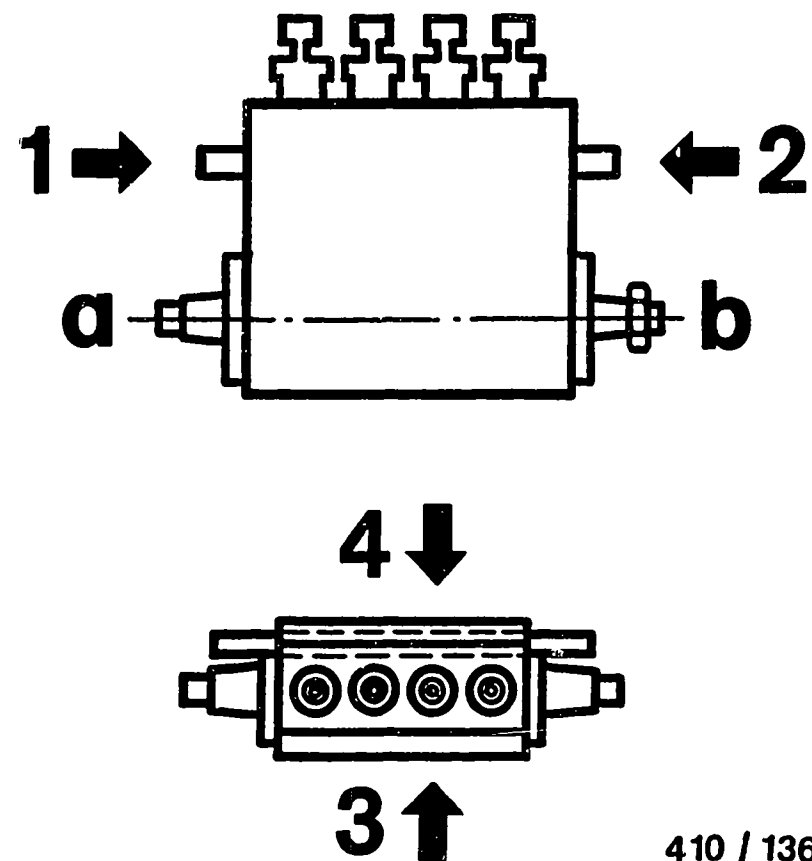
../4 = with 2 attachment holes, left hole sealed with supply pump and right hole with cover.

../5 = with 2 attachment holes, left hole sealed with cover and right hole with supply pump.

../6 = with 2 attachment holes, both covers sealed (without supply pump).

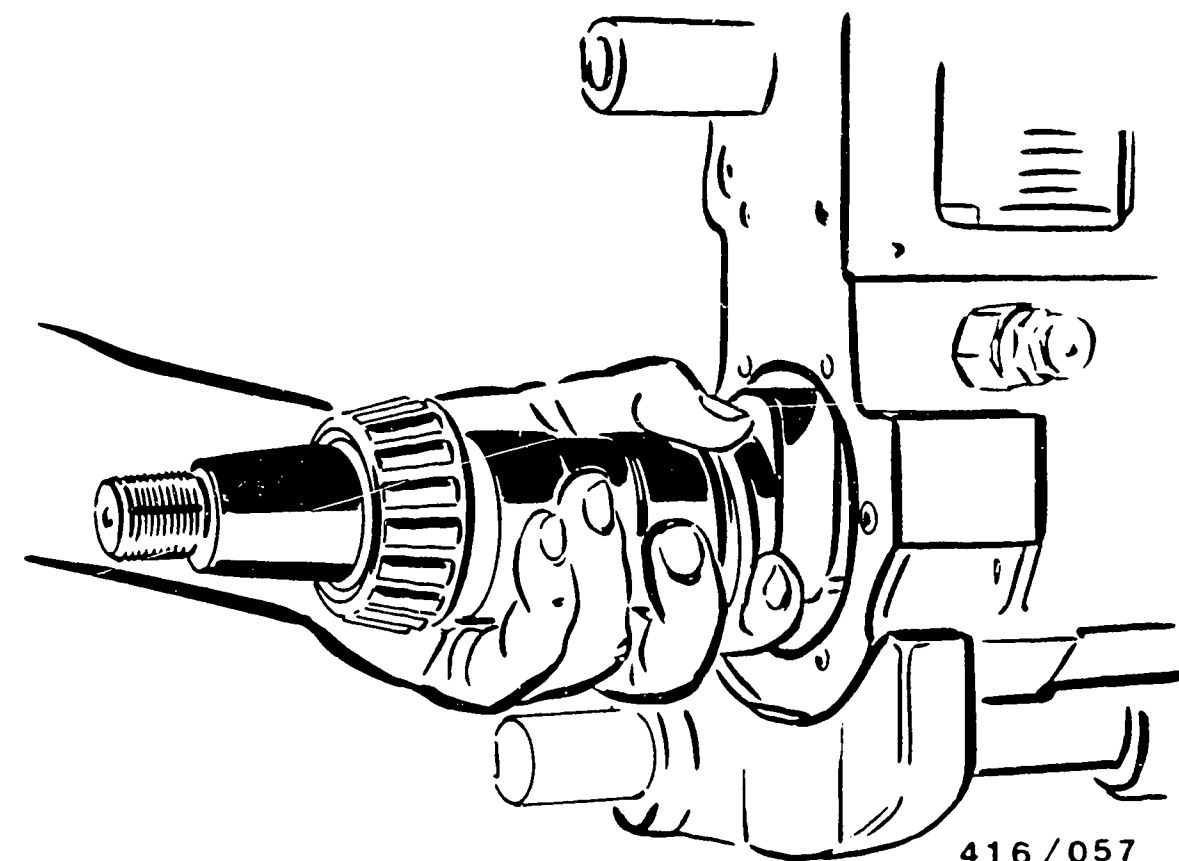
../7 = with 2 attachment holes each on sides 3 and 4, right-hand attachment hole sealed with cover.

1) The entire injection-pump assembly is turned through 180° in the case of assembly numbers starting with uneven numbers (300,500,700 etc.) with governor position 2.



410 / 136

3,4 = Pump side if cover at front and control rod at back
 a = Shaft position 1 (notch at shaft end)
 b = Shaft position 2 (notch at shaft end)



416 / 057

Insert camshaft with intermediate bearing into camshaft chamber.

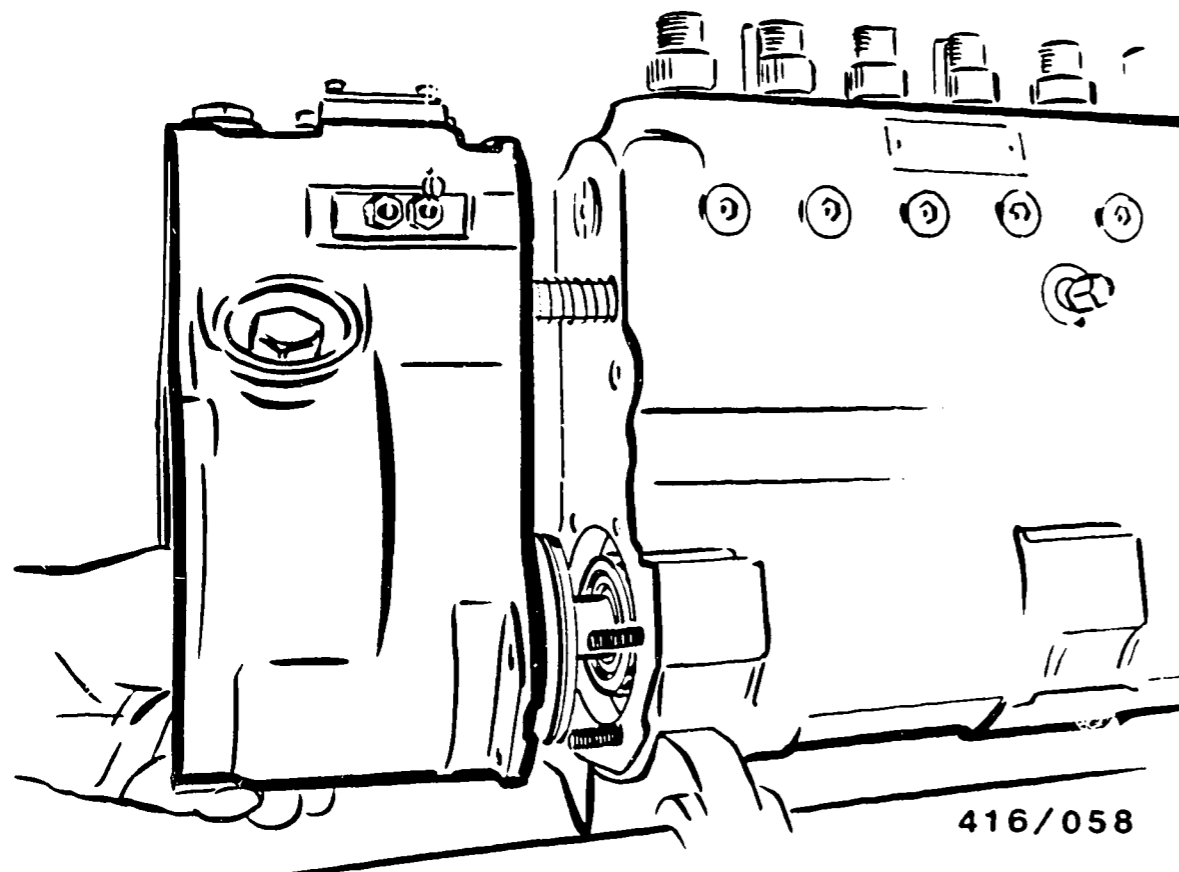
NOTE :

In order to avoid damage to radial-lip-type oil seals when fitting camshaft, use mounting sleeve in line with cone diameter.

Cone dia. 25 mm, mounting sleeve KDEP 2925
 Cone dia. 30 mm, mounting sleeve KDEP 1502
 Cone dia. 35 mm, mounting sleeve KDEP 2869

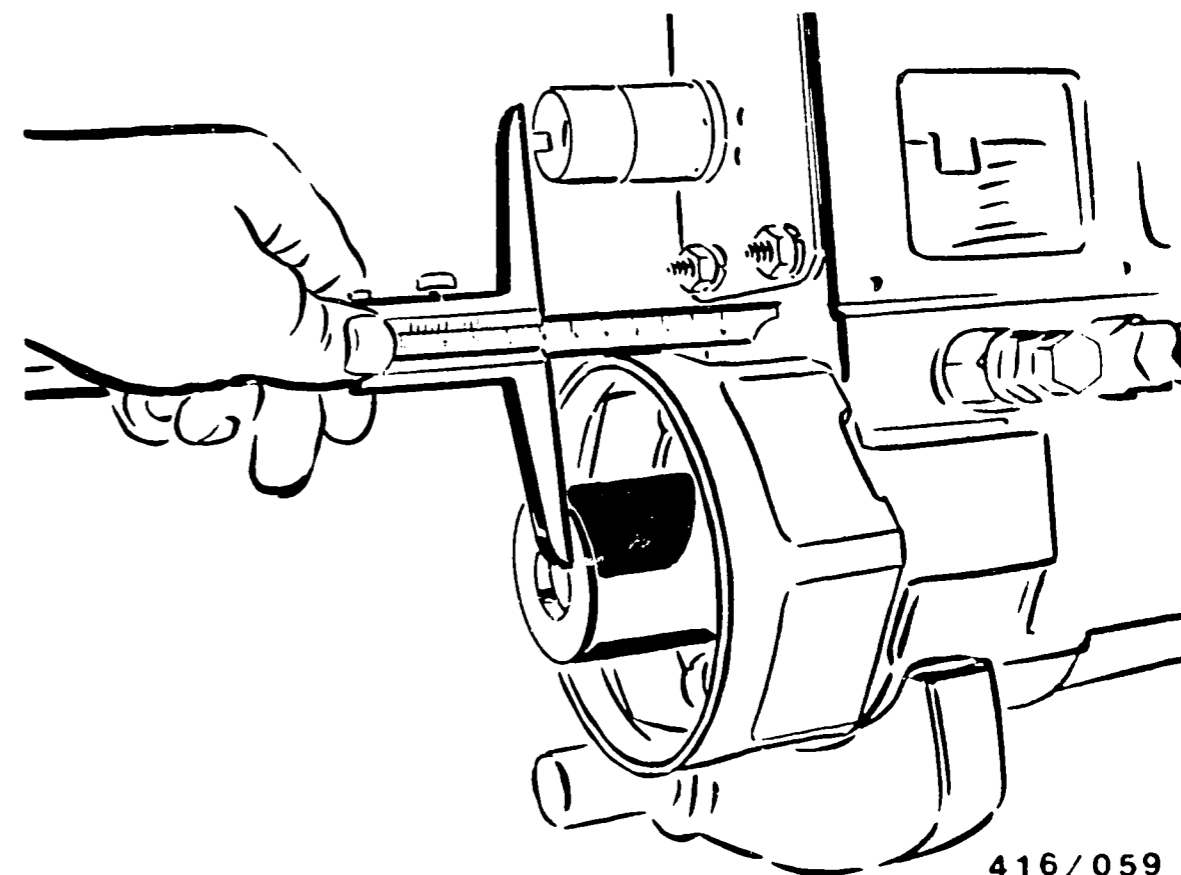
6/ 8 barrel fuel-injection pumps have 1 intermediate bearing.

10/12 barrel fuel-injection pumps have 2 intermediate bearings.



Position pump housing such that it is vertical.
 Bearing end plate?
 Fit governor housing with new seal.
 Tighten fastening screws of governor housing
 employing corresponding tightening torque.

Flat-head screw	13...18 Nm
Hexagon bolt	11...16 Nm
Hexagon nut	11...16 Nm
Canstan screw	5...7 Nm



Testing and adjustment of projection and axial
 clearance of camshaft

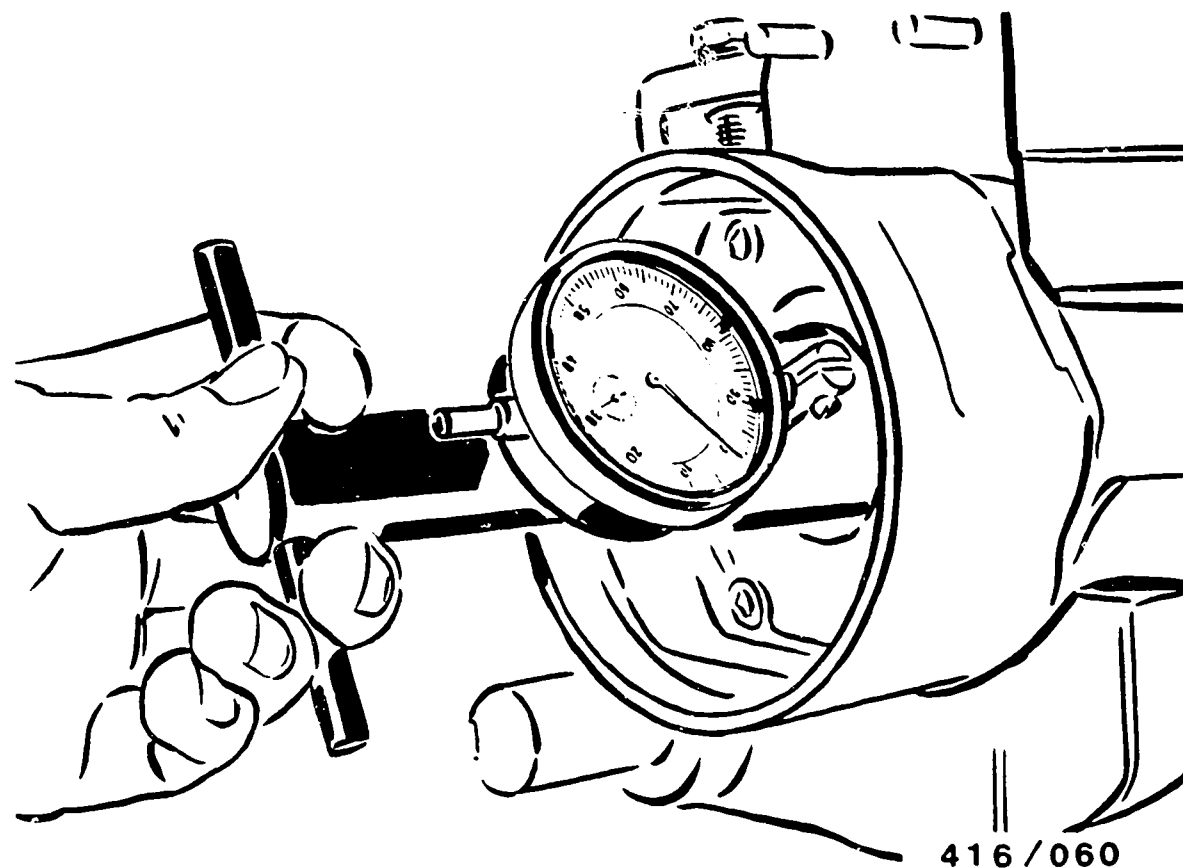
Slip measuring tool on to camshaft cone.
 Cone 25 mm
 Cone diameter 30 mm KDEP 1656

Use depth gauge to determine distance between
 top edge of measuring tool and pump housing and
 note down distance.

Set values:
 Cone 25 mm
 Cone diameter 30 mm 90 +/-0.2 mm

Projection is adjusted by way of shims beneath
 camshaft bearing.

Note:
 The axial clearance of the camshaft is likewise
 adjusted with the same shims.



Testing axial clearance of camshaft

Screw on axial-clearance measuring tool (in line with cone diameter of camshaft) on drive end.

Insert dial indicator into holder provided and pre-tension by approx. 5 mm.

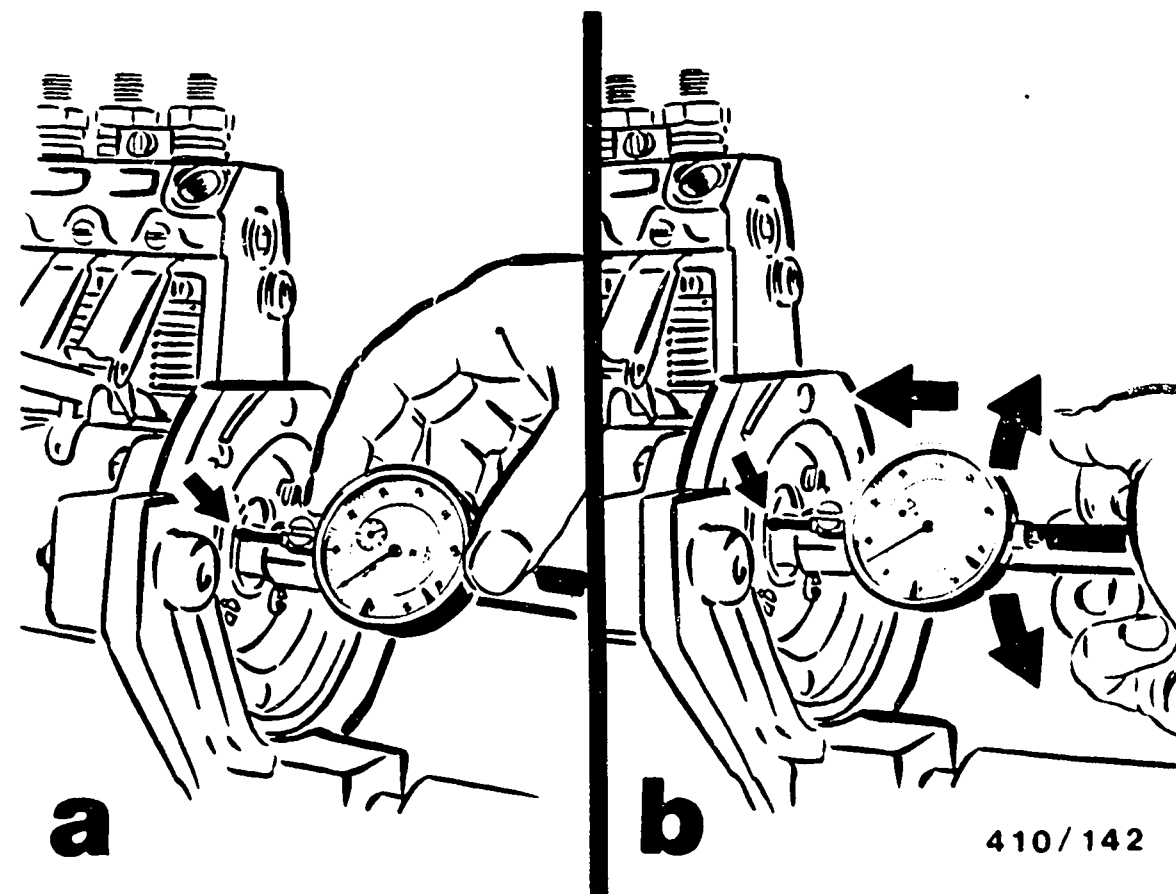
NOTE :

Measuring tool:

Cone 25 mm

KDEP 2882 for cone diameter 30 mm

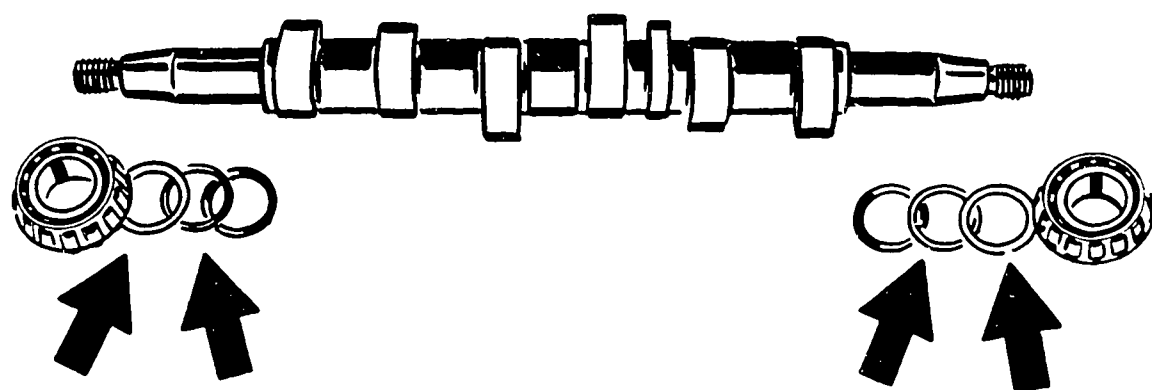
Axially tension camshaft with measuring tool employing brief, rapid turning motion (approx. 45°).



Release measuring tool.
Set dial indicator to "0" (picture a).

Then, employing same turning motion, axially compress camshaft and release at same point at which dial indicator was set to "0" (white arrows, pictures a and b).

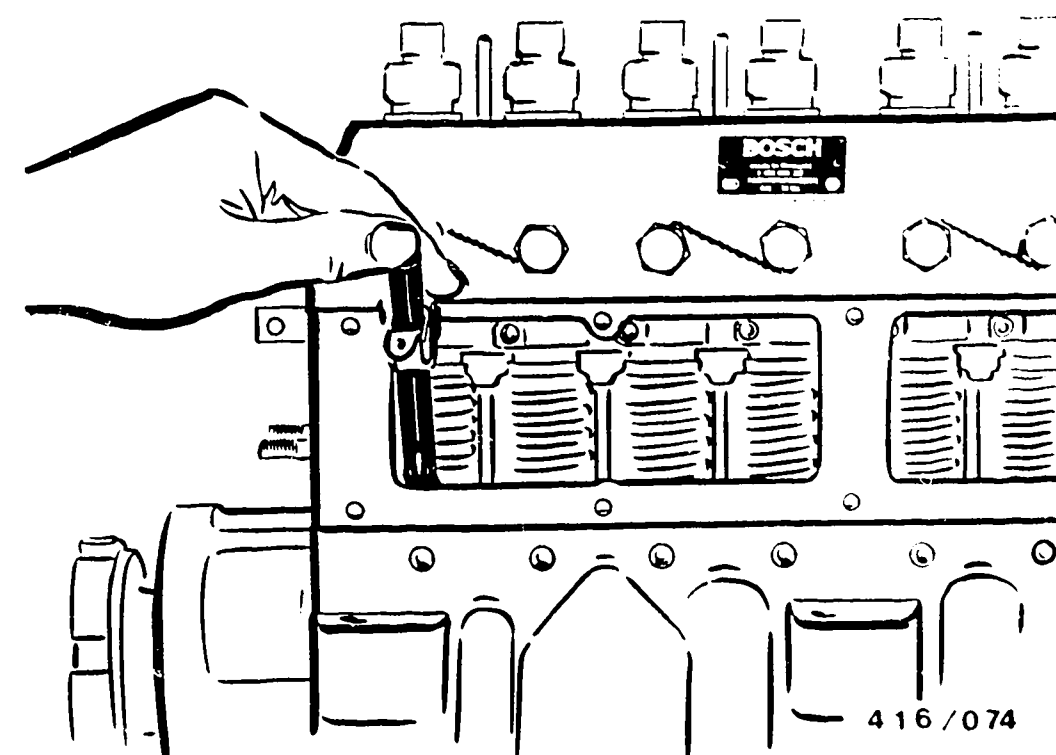
Read off axial clearance on dial indicator:
Set value: 0.02...0.06 mm



410/140

If the measured values for projection and axial clearance are outside the tolerance range, remove camshaft, press off camshaft bearing and adjust projection and/or axial clearance by changing shims (picture, arrows).

Repeat projection and axial-clearance tests.



Attach driving coupling in line with cone diameter of camshaft and tighten it (counter-hold with holding wrench).

Turn camshaft and remove tappet holder in TDC position of respective cam.

Attention is to be paid to ease of removal of tappet holder from roller-tappet hole. Removal of the tappet holder by force damages the roller tappet and tappet holder.

Check to see that control rod moves freely.

Tilt fuel-injection pump.

Note:

If control rod does not move freely, check radial clearance of control sleeve.

Check freedom of movement of control rod.

Tilt fuel-injection pump.

Note:

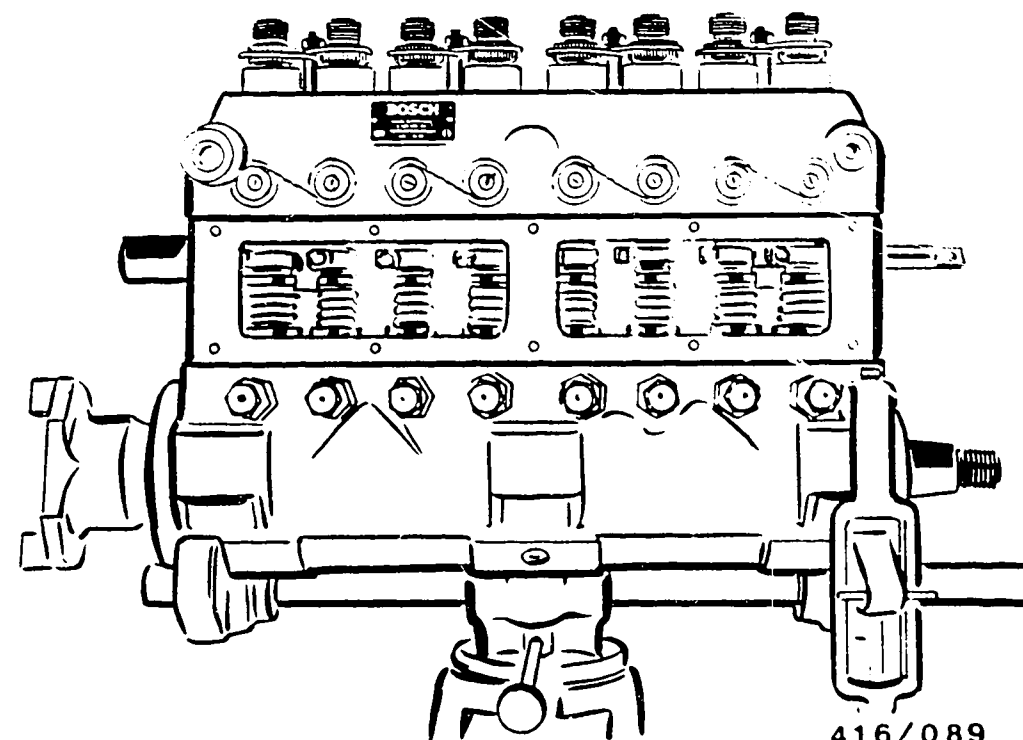
If control rod does not move freely, check radial clearance of control sleeve.

Basic adjustment of the fuel-injection pump is to be carried out before performing the work outlined below.

The camshaft is to be removed in order to be able to effect correction of the basic adjustment on fuel-injection pumps as of S 3000.

Note:

If the fuel-injection pump is not adjusted immediately, continue with assembly (see Coordinate D12).



Fitting base cover

Fit fastening screws of intermediate bearing with O-rings and tighten employing tightening torque of 20...24 Nm.

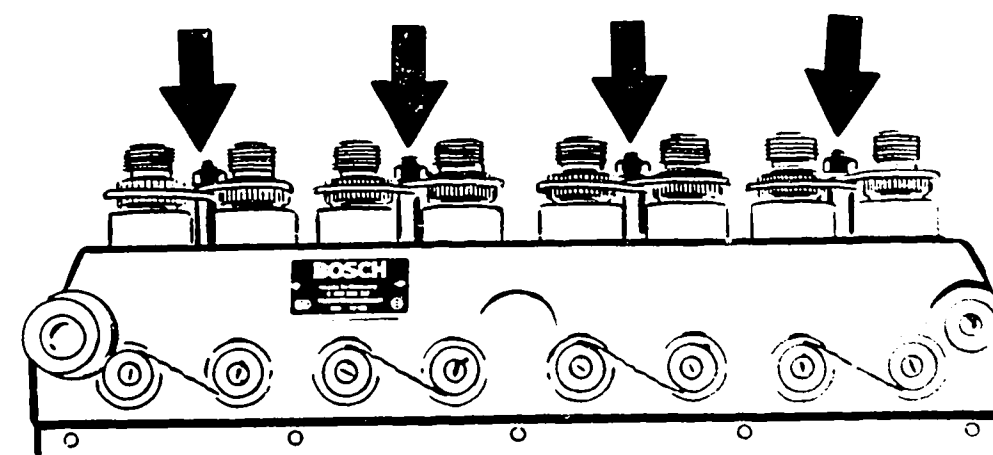
Screw in base cover and tighten with screwing tool KDEP 1072.
Tightening torque: 110...120 Nm

Pre-assemble control rod with spring, spring seat and hexagon bolt.

Assemble governor in accordance with respective repair instructions.

Only fit supply pump and spring-chamber closing cover following adjustment on injection-pump test bench.

Unclamp fuel-injection pump.



416/090

Fit straps at delivery-valve holders (picture, arrows).
Tighten nuts with tightening torque 11...15 Nm.

Leak test on camshaft, spring and governor chambers

Completely assemble fuel-injection pump.
The compressed air required for the leak test is to be supplied to the pump camshaft chamber at a suitable point.
Immerse fuel-injection pump vertically into test bath.

Test duration and test pressure:
30 min. at 5 bar, then
30 min. at 0.5 bar.

Establish by means of visual inspection whether all sealing surfaces, screw connections, seal rings and end covers are leakproof at housing and pump cover. There must be no air bubbles.

In order to avoid skin irritation, apply hand-cream beforehand and wash hands in soap and water after completion of testing.

For production reasons:
continued on the following
coordinate.

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